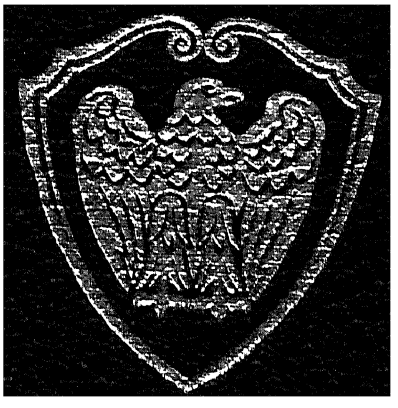


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METHOD OF CROSS REFERENCES

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The National Encyclopedia

GLOBE **G** JOHANNESBURG

GLOBE, a copper mining city of southeastern Arizona, the county seat of Gila Co., situated 75 mi. east of Phoenix. The Southern Pacific Railroad and bus lines serve the city. Copper is the chief product; and asbestos, gold, silver, quicksilver, coal and other minerals are found in the vicinity. The ROOSEVELT and COOLIDGE DAMS are near by. Northwest is Crook National Forest, and to the east the San Carlos Indian Reservation. Globe was founded in 1876 and incorporated in 1907. Pop. 1920, 7,044; 1930, 7,157.

GLOBE-AMARANTH (*Gomphrena globosa*), a hairy annual of the amaranth family, native to the tropics of the Old World and commonly grown in gardens as an everlasting. The somewhat stiff, branching stems, a foot or so high, bear opposite entire leaves, 2 to 4 in. long, and dense, round, long-stalked flower-heads, white, yellowish, red or violet in color, closely clasped by two broad, showy, leafy bracts.

GLOBEFISH, a name applied to various fishes, with a highly inflatable gullet, especially to the swellfishes (*Tetraodontidae*) and the porcupine-fishes (*Diodontidae*). They have short bodies, scaleless skin usually armed with prickles, and possess the power of distending the gullet until the body assumes grotesque proportions, becoming almost spherical in outline. *See* PORCUPINE FISH; SWELLFISH.

GLOBE THEATRE, THE, an Elizabethan playhouse particularly associated with SHAKESPEARE, formerly situated on the Bankside, Southwark, London. A hexagonal wooden structure with a circular pit—typically unroofed—and three galleries covered with thatch, The Globe was built in 1599 of materials from THE THEATRE by a company composed chiefly of Shakespeare, Richard and Cuthbert Burbage and Philip Henslowe. It accommodated some 1,200 people, showed a flag during performances, and was named from a figure of Hercules supporting the globe. The plays of Shakespeare, Jonson, Beaumont, Fletcher, Chapman and other notable dramatists were produced at The Globe, which burned in 1613, was rebuilt in 1614, and was finally demolished by the Puritans in 1644. On Apr. 23 of each year (the poet's birthday), scenes from Shakespeare's plays are presented on a movable stage on the approximate site of The Globe. *See also* BLACKFRIARS THEATRE; ENGLISH DRAMA.

GLOBE THISTLE, a genus (*Echinops*) of coarse, white, woolly thistle-like perennials of the composite family. There are about 60 species, natives of the Old World, several of which are grown as ornamentals. They are of easy culture, well adapted for shrubberies and wild gardens. Among the most popular species are *E. Ritro,* a low plant, and *E. sphaerocephalus,* growing to 5 ft. or more.

GLOGAU, a German city in Lower Silesia, on the Oder River about 57 mi. northwest of Breslau. The old city has a Gothic cathedral of the 12th century, formerly a Jesuit church, a 17th-century castle, a rathaus of 1774, a theater and a museum. Its factories produce sugar, starch, furniture, machinery and cast-iron; it also has printing works. There is much river shipping, trade in grain being predominant. It is one of the oldest cultural centers in Silesia. Mentioned 1010, it was a Polish outpost till 1202, then belonged to the independent duchy of Silesia and, after its division, was capital of the principality of Glogau from 1252 to 1506. It passed into Hungarian, Polish and Bohemian hands and became Prussian in 1741. Pop. 1925, 25,959.

GLORYBOWER, a genus (*Clerodendrum*) of handsome woody plants of the vervain family, several of which are grown in greenhouses or planted out of doors for their showy flowers. There are about 150 species native to tropical and subtropical regions, chiefly in the eastern hemisphere. They comprise trees, shrubs and woody vines usually bearing entire leaves and bell-shaped white, violet or red flowers in terminal clusters.

GLOSSOPTERIS, a genus of coarse, fernlike plants abundant and widespread during Permian time. About a dozen fossil species are recognized, one of which was found by the explorer, Scott, within a few degrees of the South Pole. The leaves are of two sorts, ordinary foliage-leaves with strongly marked midribs and smaller scale-leaves believed to have been spore-bearing. Peculiar bottle-shaped bodies, apparently spore-cases, have been found associated with them, as have also fossil seeds. The plant was not a true fern; but conclusive proof is lacking to establish it among the seed ferns. Glossopteris has given its name to a fossil flora characterizing the region known as Gondwanaland, the vast composite South American continent which geologists believe existed during Permo-Carboniferous time.

GLOUCESTER, county town and city port of Gloucestershire, England, situated on the Severn, 114 mi. west of London, and sheltered east and west by

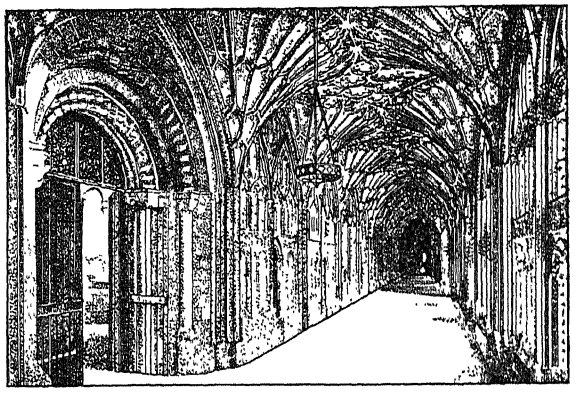
the Cotswolds and the Forest of Dean. A venerable city of picturesque timbered and gabled houses, it follows Roman planning. Once the focal point of so many religious foundations that "as sure as God's in Gloucester" became a byword, even to-day there are numerous churches besides the cathedral. St. Mary de Lode, on Roman temple foundations, is largely Norman; St. Mary de Crypt is 12th century; and the churches of St. Nicholas and St. Michael were connected with ancient abbeys. Fragments of monasteries and city walls survive. Gloucester also held the first Sunday School (1780), and in its park is a chalybeate spa. The modern city has thriving industries and a large trade carried by the Berkeley Canal to the Severn Estuary. Cider, cheese and broadcloth are among many manufactures, and salmon and lamprey fisheries are valuable. Pop. 1921, 51,330; 1931, 52,937. *See also* GLOUCESTER CATHEDRAL.

GLOUCESTER, a city and port in Essex Co., eastern Massachusetts, situated 28 mi. northeast of Boston. It is served by the Boston and Maine Railroad and steamer lines. Preeminent as the salt-fishing port of America, its natural charm and historic and romantic interest have made this city the most popular summer resort on Cape Ann. More than half of the 196 vessels of over 5 tons gross documented at Gloucester are engaged in the fisheries. The total catch here in 1929 was about 90,000,000 lbs., with estimated receipts at $3,900,000; but many times this amount was caught by Gloucester vessels which range north and south along the Atlantic coast. Harbor commerce in 1930 amounted to 64,871 tons, valued at $1,772,138. Cape Ann granite has furnished the stone for many fine American buildings. Local manufactured products, including many subsidiaries and by-products of the fishing industry, were valued, in 1929, at $13,827,974. The retail business in 1929 amounted to $14,105,881.

Gloucester was a fishing station in 1624 and was the first settlement made on the north shore of Massachusetts Bay. The town was incorporated in 1642, and in 1874 the city received its charter. On Ten Pound Island, in the harbor, are a Government fish hatchery and a U.S. Coast Guard flying base. Fissures, reefs and a terminal moraine are geologic phenomena of the vicinity. Gloucester has been celebrated in song and story, by Longfellow in *The Wreck of the Hesperus,* by Kipling in CAPTAINS COURAGEOUS, by Elizabeth Stuart Phelps-Ward in *A Singular Life* and other books, by James B. Connolly and others. Summer residents usually double the population. Pop. 1920, 22,947; 1930, 24,204.

GLOUCESTER, a city of Camden Co., N.J., situated at the convergence of Newton Creek and the Delaware River opposite Philadelphia and adjoining Camden on the north. It is served by the Pennsylvania and the Reading railroads, motor buses and ferries to Philadelphia. Industries include the manufacture of lighting fixtures, paper, rugs, silk and cotton fabrics, woolen yarn and boats. In 1929 the factory output reached approximately $11,000,000; the retail trade amounted to $3,888,548. Near Gloucester the Dutch founded the short-lived Fort Nassau in 1623, and a permanent settlement was established in 1689. Gloucester was the scene of considerable fighting during the Revolutionary War, including a successful attack by General Lafayette on a force of Hessians who were occupying the town. It received its charter in 1868. Pop. 1920, 12,162; 1930, 13,796.

GLOUCESTER CATHEDRAL, Gloucester, England, built as a Norman church late in the 11th century, was greatly altered some 300 years later and practically recased in Perpendicular Gothic, so that its exterior is now a complete and very beautiful example of that style. Unlike many churches, Gloucester, which was the place of worship of a Benedictine abbey, had no special shrine or patron saint. After the murder of King Edward II at Berkeley Castle, Sept. 21, 1327, several monasteries refused to receive his body for fear of offending the queen. The Abbot of Gloucester brought the dead ruler's body to the abbey in his own carriage, and gave it a burial in Gloucester church. Almost immediately, as a result, the church became a goal of pilgrimage and was



CLOISTER OF GLOUCESTER CATHEDRAL
14th century Gothic architecture

greatly enriched. This enrichment rendered possible the rebuilding which has made Gloucester one of the most celebrated cathedrals in England.

The choir, dating from the middle of the 14th century, is a gem of the Perpendicular period and one of its first monuments. It is particularly admired for its vaulting, carving and window tracery. The elaborate fan vaulting of the cloisters, erected in 1350-1410, is the earliest known. The lady chapel, rebuilt about 1490, is uncommonly fine, as is the highly ornamented central tower of the same period. Interiorly the reredos and the tomb of Edward II are among the cathedral's noteworthy features. The east window, though the largest in England and among the largest in the world, is one of the earliest examples of Perpendicular tracery.

GLOVERSVILLE, a city in Fulton Co., eastern New York, situated just north of Johnstown and 43 mi. northwest of Albany. The Fonda, Johnstown and Gloversville Railroad serves the city connecting with

the New York Central at Fonda, 7 mi. south, and there is an airport. Gloversville with Johnstown forms one of the most important glove-making centers in the world, producing silk and leather gloves, and many varieties of mittens. Leather tanning and trade connected with glove-making are carried on. In 1929 Gloversville's manufactured output was worth about $31,300,000; the retail trade amounted to $15,400,000. Sir William Johnson's colony from Perthshire, England, settled here about 1760 and started the glove industry. The village was known as Stump City until 1828. Incorporated in 1851, it became a city in 1890. Pop. 1920, 22,075; 1930, 23,099.

GLOVES. The use of gloves has at various times been attended by symbolical significance which has in some instances been carried to the present. They are worn in some church ceremonies. In general gloves may be divided into two classes, skin gloves and fabric gloves.

Skin Gloves. Most leather gloves are made of sheepskin although the skins of other animals including the pig, dog, kid, goat, lamb, colt and reindeer are sometimes used. Genuine chamois comes from the chamois, a mountain antelope, although most so-called chamois is made from sheepskin; the Mocha glove is prepared from the skin of the Arabian or Mocha sheep; Cape glove originally named for the Cape or South African sheep is now prepared largely from lamb and sheepskins; suede is prepared by finishing the flesh side of lamb in sheepskins. Manufacturing processes consist of cleaning the raw skin, dressing, softening and coloring the leather and cutting and sewing the gloves. Many methods of dressing are in use depending on the type of material and the finish desired. Capes are colored by dipping so that the color is absorbed through the entire skin; certain other gloves are colored only on one side by brushing. Gloves are cut from the stretched skin by a die in a punch press. The sewing may be done either by hand or by machine. X.

Fabric Gloves, using most of the main textile fibers, fall, as do leather gloves, into the two not wholly separable classes of utility and adornment. In the latter pure silk is preëminent in two forms of warp-knit fabric—Tricot and Milanese. Some fine rayon (*see* YARNS, SYNTHETIC) is also used in similar cloths but not so universally. Allied with these are cotton gloves in a variation Tricot known as Atlans. This cloth is shrunk by means of concentrated caustic solutions and is subsequently finely napped in close simulation of sueded leather. Silk, rayon and cotton dress gloves are die-cut to shape and seamed together. They are made in various lengths and trimmed with embroidery, applique-work, fancy cuffs and so on. Woolen gloves are not die-cut but are knit in whole or in part as a complete article. In the main the only gloves not made of knit fabrics are the common twill work gloves. Work gloves are also made of heavy cotton circular knit goods. Where extreme heat is encountered gloves made of ASBESTOS fibers are often used. Fabric gloves are manufactured in most of the textile countries, especially the United States in the states of New York, New Jersey and Pennsylvania. Sueded cotton gloves are made in Germany and Czecho-Slovakia on a large scale. R. PR.

GLOW-WORM, a popular British name for the wingless, caterpillar-like female of a European firefly (*Lampyris noctiluca*). After nightfall in late spring and early summer they glow in damp ground and attract the males by their greenish, almost continuous light. The larvæ feed on small soft-bodied animals such as slugs and insect larvæ. Larvæ and wingless females of American fireflies are sometimes called glow-worms.

GLOXINIA, the florists' name for *Sinningia speciosa,* a small plant of the gesneria family, native to Brazil, highly prized in numerous varieties for greenhouse culture. It is a low, nearly stemless herb, bearing soft, velvety, wavy-margined leaves, and large showy, violet or purplish flowers, each on a long stalk. Some varieties have white-nerved leaves and white or red flowers.

GLUCINIUM. *See* BERYLLIUM.

GLUCK, ALMA (stage name of Reba Fiersohn) (1886-), American soprano, was born at Bucharest, Rumania, May 11, 1886. She came to the United States in 1890, and in 1909 made her début as Sophie in Massenet's *Werther* at the Metropolitan Opera, New York. In her first season she sang 11 rôles. In 1912 she retired from regular operatic appearances to resume vocal studies with MARCELLA SEMBRICH in Berlin, thereafter devoting herself to recitals, in which she gained renown as a *lieder* singer. In 1914 she married EFREM ZIMBALIST, the violinist.

GLUCK, CHRISTOPH WILLIBALD VON (1714-87), German music composer, was born at Weidenwang, on July 2, 1714. As a youth he studied music at the Komotau Jesuit College and later, under the patronage of Prince Melzi, went to Milan, where he continued his musical education under Sammartini. He made his bow as a composer at the age of 27 with the opera *Artaserse,* which with others won him such popularity that he was invited to London in 1745 to compose for the Haymarket Theatre. He went to Copenhagen in 1749, and returning to Vienna was appointed director of the court opera, holding this post from 1754 to 1764. As singing master to Marie-Antoinette he won the esteem of the future queen of France, whose loyalty was later to prove valuable. Under the influence of Handel's music, his genius acquired depth and momentum. He reached creative maturity unmistakably in *Orfeo ed Euridice,* produced in Vienna in 1762. Five years later he completed *Alceste.* In 1772 he found a hostile audience in Paris and was able to obtain production of *Iphigénie en Aulide* only with the aid of Marie-Antoinette. His next opera was *Armide,* followed by his greatest opera, *Iphigénie en Tauride.* Retiring to Austria he suffered an apoplectic stroke in 1784, and succumbed to a second stroke, dying at Vienna, Nov. 25, 1787.

The five operas last mentioned are not only Gluck's most important labors but also are as significant as any operas in music history, save perhaps for the works

of CLAUDIO MONTEVERDE in the sixteenth century.

GLUCOSE, an organic chemical compound belonging to the group of carbohydrates, and also known as DEXTROSE or GRAPE SUGAR. Chemically it is a monosaccharose, of formula $C_6H_{12}O_6$, and is called an aldose, or aldehyde-alcohol, since it contains groups typical of the aldehydes and of the alcohols. Its solution rotates the plane of polarized light to the right, from which it derived the name dextrose; it reduces Fehling's solution, but, unlike other sugars, remains unaffected by boiling with dilute acids, and is not carbonized (charred) by strong sulphuric acid. As its name indicates, it occurs in grapes, as well as in many other fruits, and is formed generally by the INVERSION of other carbohydrates: cane sugar or sucrose gives rise to fructose and glucose; lactose yields galactose and glucose; maltose only glucose. Industrially it is prepared on a large scale by the inversion or hydrolysis of STARCH and DEXTRINS, in the United States largely from corn—whence it is also known as corn-syrup—in Europe mostly from potatoes, but also from wheat flour. Since it crystallizes only with difficulty, and has a pleasant sweet taste, it finds application in syrups for the table, or for confectionary purposes, is used extensively as a sweetening agent in industry, and is mixed with cane-sugar, molasses, or used alone in the fermentation process and the making of alcohol. *See also* CARBOHYDRATES; SUGAR: Chemistry. W. J. L.

GLUE, the adhesive, gelatinous or viscous product obtained usually from hides, bones, sinews, blood albumen, milk casein, or similar animal product. Normally, glue is a brittle solid but it is prepared also in liquid form by the use of chemicals such as acetic acid or calcium chloride. Though glue has been known and used for at least 30 centuries, its manufacture on a large commercial scale and the intensive study of its chemical and physical properties are a comparatively recent development.

Good glue must have adhesive qualities greater than the natural bond of the fibers, so that breaks will come in the fiber rather than in the glue. Animal glue is the standard that has been used for centuries, made from bone, hide and other waste animal products. Animal glue and the surface to which it is applied must be kept at temperatures between 80 and 100° F. Casein glue, made from the curds of milk, caustic soda and hydrated lime, results in a water-resistant wood glue. Casein glue is favored for airplane construction. Vegetable glue is a carbohydrate product made principally of cassava flour; it is prepared by cooking and mixing with caustic soda and other ingredients, and gives a thick viscous liquid that has advantages in economy, strength and holding power for wood, veneer and plywood. Albumin glue is dried blood and has a two-stage adhesive quality. First, by the ordinary drying out of glue water, and, second, by the coagulative processes when heated to 160° F. Albumin glue when coagulated is nonsoluble in water and, with casein glue, is one of the two approved glues used for airplane and marine construction under the United States specifications.

The process of glue manufacture varies with the source of material but essentially it consists in the treatment of hides, bones and horn piths in a manner that frees them of fatty, mineral, and other impurities and leaves a colloidal product, COLLAGEN, which is the mother substance of glue. The collagen is softened by cooking in hot water. Subsequent operations include filtering and treatment with chemicals, depending on the color and consistence desired. Besides its familiar use as a strong adhesive, glue is widely used in the arts and industries to produce hard smooth surfaces, to act as a binder, and to give added stiffness to delicate articles. The annual production of glue from animal sources, in the United States is approximately 100,000,000 lbs. a year.

GLYCERIDES. Glycerol reacts with organic and inorganic acids to produce mono-, di-, and tri-glycerol esters. The most important of the esters are the FATS and VEGETABLE OILS. These are mostly mixed triesters of the fatty acids, oleic, palmitic and stearic but practically all of the fatty acids are found in nature combined with glycerol. Tri-nitroglycerol is the most important of the inorganic esters and is used in the production of the nitroglycerol explosives. Glycerol phosphate is used extensively as a medicine. The triester of glycerol with acetic acid is used as a means of the quantitative determination of glycerol and is used commercially as a camphor substitute. *See also* GLYCEROL. J. W. L.

GLYCEROL, commercially known as *glycerine,* is found in combination with FATTY ACIDS as esters in FATS and many VEGETABLE OILS. It is a tri-hydric alcohol, $CH_2OH : CHOH : CH_2OH$, possessing the properties of an alcohol in that it can be converted into mono-, di-, or tri-esters with acids. It also possesses the properties of a weak acid in that mono, di and tri metallic salts can be readily produced. There are twelve oxidation products of glycerol. Due to its sweet taste, its great power to absorb and hold moisture and its antiseptic properties it is used in keeping many products such as candies, cake, bread and tobacco from drying out. It is an excellent antifreeze agent for use in auto radiators, it is used in pharmaceutical preparations, tooth paste, lotions, and medicinally, but its greatest use is in the production of tri-nitroglycerol commonly called NITROGLYCERINE which is the base of the explosive DYNAMITE.

Glycerol is produced very largely as a by-product in the manufacture of soaps from fats and vegetable oils. When they are reacted upon by alkalis, steam under high pressure, enzymic action or hydrolysis by catalysts such as Twitchill's reagent, the fats or oils are decomposed giving free fatty acids or their salts (soap) and glycerol. The soaps or fatty acids are separated, the glycerol solution is purified chemically, evaporated and distilled under vacuum at as low a temperature as possible.

Glycerol can also be produced from sugar or molasses by yeast fermentation in water solution in the presence of acid, neutral and basic salts. Yields of

glycerol of as high as 48% of the sugar can be obtained in the presence of a mixture of molecular proportions of sodium sulphite and sodium acid sulphite, of 27% in the presence of sodium carbonate. After the fermentation is completed, the beer is distilled to recover by-product alcohol, evaporated to remove most of the salts and is then purified somewhat by chemical treatment before distillation. The fermentation process gave a new source of glycerol. It can be produced at a cost to compete favorably with glycerol from soap stock. Glycerol can also be produced synthetically from propylene gas by chlorination and treatment of the monochlorpropylene with hypochlorous acid, the product on hydrolysis giving glycerol.

Glycerol has a specific gravity of 1.2653 at 15.6° C. and boiling point of 290° C. at 760 mm. pressure. It is soluble in water, alcohols, but insoluble or only slightly soluble in carbon tetrachloride, chloroform, ether and carbon bisulphide. J. W. L.

GLYCOLS are dihydroxy alcohols having chemical and physical properties intermediate between those of the regular ALCOHOLS and GLYCEROL. The three best known glycols are ETHYLENE, propylene, and trimethylene. There are also so-called poly-glycols, such as diethylene glycol, which are both glycols and ETHERS. Propylene and trimethylene glycols are usually found as fermentation products from rancid fats and oils. They have almost no commercial value and are rather considered as undesirable impurities when found in glycerol. Ethylene glycol is produced synthetically from ethylene by reacting with hypochlorous acid to produce monochlorohydrin which in turn is hydrolized with a weak solution of sodium carbonate to ethylene glycol.

$$\begin{matrix} CH_2 \\ \| \\ CH_2 \end{matrix} + HOCl \rightarrow \begin{matrix} CH_2Cl \\ | \\ CH_2OH \end{matrix} + HOH \rightarrow \begin{matrix} CH_2OH \\ | \\ CH_2OH \end{matrix} + HCl$$

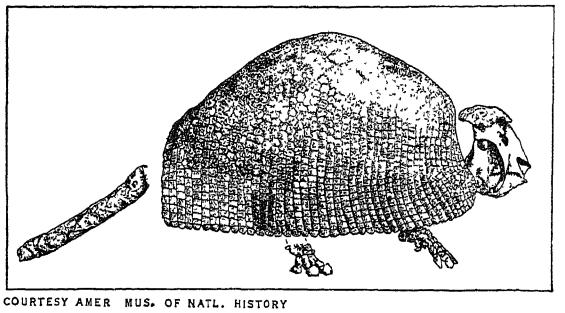
(Monochlorohydrin) (Ethylene glycol)

Ethylene is obtained either from ethyl alcohol or by separation from the gases produced in the cracking of petroleum oils and from certain natural gases.

Ethylene glycol is a slightly sweet mobile liquid having a specific gravity of 1.11757 at 15.6° C. and a boiling point of 197.2° C. at 760 mm. pressure. It is used largely in EXPLOSIVES as ethylene glycol dinitrate, replacing part of trinitroglycerol in low-freezing DYNAMITE and blasting gelatine explosives. It is also used in quantities as an anti-freeze for automobiles. Several derivatives are made for use as solvents and plasticisers for nitrocellulose lacquers. J. W. L.

GLYPTODONT, the tortoise-armadillo, one of a group of huge, grotesquely armored mammals. found fossil in pampas deposits in South America and also (their Pliocene ancestors having strayed northward across the isthmian land-bridge) in Texas and Florida. The ancient glyptodonts were unable to roll themselves up like their nearest living relatives, the active little armadillos, the plates of their massive shells being welded into a rigid dome of bone. The animals were practically invulnerable to attack from the saber-toothed tigers and great bears of the period. The mailed head could be drawn like a turtle's within the shell. Their feet were shod with broad, hooflike claws. The tail was protected by bony rings, in some genera bristling with spikes, or ended in a formidable horned club of bone.

The largest glyptodonts were 12 to 14, or even 16 ft. long over all, and stood 5 ft. or more in height. The fossil shell of one of these super-giants was 3



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GLYPTODONT

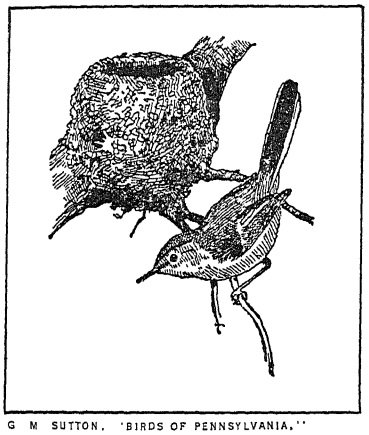
in. thick, as large as a hogshead, and weighed a quarter of a ton. The primitive North American species, *Glyptotherium texanus,* was somewhat smaller. Although classified as edentates, glyptodonts take their name from their curiously fluted teeth.

GNAT, a popular name for many species of very small flies, mainly of two families. Those of the family *Cecidomyiidæ* are called gall-gnats. The larvæ of many species of these insects cause the growth of galls on plants. Other species cause arrested growth in host plants. Larvæ of a few species of gall-gnats produce living young, a type of reproduction known as pædogenesis. The Hessian fly, the wheatmidge, the clover-flower and clover-leaf midges, belong to this family. Fungus-gnats, of the family *Mycetophilidæ,* are often seen on fungi and in damp places on decaying vegetation. Many live upon and destroy mushrooms. Others are found in decaying wood or under tree bark. Mosquitoes are called gnats in England.

GNATCATCHER, a genus (*Polioptila*) of small gray birds of the Old World warbler family (*Sylviidae*) allied to the kinglets, found in the warmer regions of the New World. They are flycatcher-like in appearance, though only about 5 in. long, with a slender depressed bill and plain grayish body plumage and black tails. The blue-gray gnatcatcher (*P. caerulea*), ranging from the central and eastern states to the West Indies and Central America, is a very active bird, frequenting the tops of trees where it feeds upon various insects. Although in early spring its notes are shrill and noisy, it later develops a soft, sweet song. It builds a compact, deeply cup-shaped lichen-covered nest on a horizontal branch of a tree and lays 4 or 5 spotted, bluish-white eggs. Several allied forms occur in the southwestern states.

GNEISS, a term applied to banded rocks of metamorphic origin, whether originally sedimentary or igneous. The bands in gneiss are mineralogically un-

like, irregular and may vary from a fraction of a centimeter to many centimeters in thickness. The minerals in these bands are usually BIOTITE, FELDSPAR, HORNBLENDE and QUARTZ. The rock is the result of the metamorphic action of heat and pressure on preexisting sandy or clayey sediments or such IGNEOUS ROCKS as GRANITE, SYENITE and GABBRO.



G M SUTTON, "BIRDS OF PENNSYLVANIA," J HORACE MC FARLAND CO. COPYRIGHT

BLUE-GRAY GNATCATCHER

Gneiss is of widespread occurrence, and is especially abundant in the older geological formations, in Canada, Africa, the Appalachian and Cordilleran mountain chains in the United States, and around the Great Lakes. It is used in the construction of rough walls and for curb stones. *See also* SAND; CLAY; PETROLOGY; METAMORPHISM.

GNETUM, a small genus of woody gymnospermous plants of the family *Gnetaceæ,* including about 30 species in tropical Africa, Asia, and South America. In its twining habit and broad leaves it is quite unlike the majority of gymnosperms and suggestive of the dicotyledons, which it also resembles in floral anatomy and in the presence of tracheæ in the wood. For these reasons *Gnetum* has been considered by some to represent a connecting link between gymnosperms and dicotyledons. The seeds of some species are edible. *Gnetum Gnemon* is occasionally seen in conservatories. H. A. G.

GNOME, a compact sententious saying, usually embodying some moral precept or maxim of wisdom. The Bible and the ancient literatures of the East contain many gnomes. A group of gnomic poets flourished in Greece, in the 6th century B.C., including Solon, Xenophanes and Theognis. Juvenal, Lucan and Publius Syrius wrote gnomic poetry in Latin during the 1st century A.D. Francis Quarles (d. 1644) and Gui de Pibrac (d. 1584) produced some excellent gnomes in English and French respectively.

GNOMON, the rod or triangular plate on a sundial and which by the position of its shadow shows the time of day. The term also applies to a pillar or other object used in finding the altitude of the sun at noon. In Greek geometry the shaded parts of these parallelograms were gnomons.

GNOSSUS. *See* CNOSSUS.

GNOSTICISM, the name given to an eclectic philosophy of religion, containing Hellenic, Oriental and Jewish elements, which flourished in the early centuries of the Christian Church. The term is derived from the Greek word *gnosis,* meaning knowledge, but the Gnostic's idea of knowledge was a sort of mystic enlightenment arrived at through divine revelation rather than reason.

Gnosticism concerned itself chiefly with the nature of the Absolute and the beginnings of evil. Its origin antedated the introduction of Christianity, but in the 2nd century, it became fused with certain Christian conceptions of cosmology. Among the various Gnostic systems there was much diversity; but common to all was the doctrine of dualism, the opposition of good and evil, of spirit and matter. Generally, the chief tenets of Gnosticism were as follows: transcending all creation is the First Cause of all being, the Father-God; below him is a complicated series of beings of divine origin; infinitely remote from him is the deity, or Demiurge, who created the world of matter, which is evil, and therefore cannot be the creation of the good Father-god; pure souls may be redeemed through the intervention of a divine emissary, Christ, from the Father-god.

Gnosticism declined rapidly after the 3rd century, although its tendencies reappeared in some later sects, such as the Manichaeans. *See* MANICHAEISM.

GNU, an African antelope (genus *Connochætes*), noted for its singular appearance. The brindled gnu, especially, appears as if formed by the union of a pony and a cow. The head is bovine in shape, the face and throat hairy, the horns bent laterally, then upward as in the muskox. The neck has a mane, the shoulders are heavy, the rump sloping and bearing a long, hairy, horselike tail; in the brindled gnu, the tail is black, but another species has a white tail. Both are noted for their grotesque behavior when alarmed, and for the vast herds that existed a generation ago.

GOA, a city of Portuguese India, situated at the mouth of the Mandavi River, 250 mi. southeast of Bombay. It was formerly the capital of the Portuguese possessions in India. At one time Goa was one of the most magnificent cities of the East, containing some of the most splendid churches and palaces in India. There still remain the chapel of St. Catherine, the convent of St. Francis, built in 1517, and the church of Boni Jesus, which contains the tomb of St. Francis of Xavier. Goa was taken by the Portuguese from the King of Bijapur in 1510 and was at that time one of the main gathering points of the pilgrims from India to Mecca.

Owing to cholera epidemics and the decline of Portuguese power in the East, old Goa lost its importance. In 1759 the residence of the Dutch viceroy was transferred to Panjib, or New Goa. New Goa is well-built, is connected by rail with British India, and has excellent harbor facilities. The new town has practically no industries and no foreign trade, ex-

cept for negligible quantities of rice, spices and coconuts which are exported. Pop. about 7,000.

GOAT (*Capra hircus*), a hoofed mammal of the family *Bovidæ* often confused with the sheep, which is of a different but related genus. Goats are differentiated from sheep by the offensive odor of the males and the bearded chin. Both sexes of goats have horns, except for the hornless Nubian variety. Goats probably originated in Persia, although they have been so long domesticated that their earliest ancestor is unknown. From Persia they spread into Greece, northern India and southern Europe. They were domesticated by the Swiss Lake Dwellers, their bones having been found in several excavations, and by the Egyptians, who pictured them on ancient monuments.

They are still found wild from the Spanish Pyrenees eastward to the great plateaus of central Asia. The ibex (*Capra ibex*) of Europe belongs to the family, as does the markhor (*Capra falconeri*) of the Himalayas. Of the various breeds evolved during centuries of domestication, the most notable are the Angora, Egyptian, Syrian and African. The most valuable domestic breeds are the Angora and the Kashmir. Both have a thick undercoat overlaid with an outer coat of different consistency. In the Angora, the inner coat is of short coarse hair, the outer coat of long curly wool being the more valuable. Each animal yields about 2 lbs. at each clipping. The Kashmir goat has a hairlike outer coat. The inner coat, a soft down of grayish color, is the valuable fleece, weighing about half a pound an animal.

In several countries, especially in the south of Europe, goats are kept for their flesh and milk. Herds of Angora goats have been established in the United States with considerable success, especially on the Pacific coast and in the Southwest, and immigrants have introduced milch-goats in various localities. Goats are sometimes kept as pets and can be trained to draw small carts. Goat leather is used for gloves and for other commercial purposes, and the true morocco leather of bookbinding is made from dyed goatskin.

The so-called Rocky Mountain goat (*Oreamnos americanus*) of North America is not a true goat, but belongs close to the chamois of Europe.

G. E. F.

GOATSUCKERS, a numerous family (*Caprimulgidae*) of mostly nocturnal birds so-named because of the ancient erroneous belief that they sucked the milk of goats. There are about 100 species of wide distribution, though most abundant in the tropics; about half are native to the New World, but only six species extend into the United States. They are mostly birds of medium size with a short weak bill, a widely gaping mouth, often provided with a fringe of long bristles, short legs and soft plumage mottled with brown, gray, black and white. The goatsuckers seek their food, which consists almost entirely of insects, chiefly at night, catching their prey in their enormous mouths while on the wing. Their striking and characteristic cries are loud, mournful and often strangely human. These birds build no nests but deposit two eggs, usually whitish with darker markings, on the ground or upon a bare rock. For the species found in the United States see the articles on chuck-will's-widow, nighthawk, poor-will, and whippoorwill.

GOBAT, CHARLES ALBERT (1843-1914), Swiss parliamentarian, was born at Tramelan, May 21, 1843. From 1868-82, he practiced law at Deleinont, in 1882 became a radical member of the Great Council at Bern and was successively a member of the Federal Council of States and the National Council. In 1892 he was made chairman of the Interparliamentary Union in Bern, and founded its permanent bureau, over which he presided until 1906 when he succeeded Elie Ducommuns as president of the International Peace Bureau. In 1902 the Nobel prize was awarded to him for his efforts in behalf of peace. He wrote, among other works, *Le Cauchemar de l'Europe,* and *L'Histoire de la Suisse racontee au Peuple.* He died Mar. 16, 1914.

GOBI, an immense tract of desert country, the Shamo or "sand sea" of the Chinese, which occupies the center of the high table-land of Eastern Asia. The total area is estimated at about 300,000 sq. mi.; its general elevation is over 4,000 ft. above sea level. From the broadest possible point of view Mongolia consists of the great desert of Gobi continuous with that of Chinese Turkestan to the southwest, but fringed on the northwest, northeast and east by a more fertile belt. The results of the recent expeditions of the American Museum of Natural History have added much to the general knowledge of the whole area.

The great basin of the Gobi contains many minor basins called *talas*. Each *tala* has its own local interior drainage and is bounded by inconspicuous warp divides or by mountain ranges. Within each *tala* are still smaller basins which contain late Mesozoic or Tertiary sediments. These have been termed *gobis*. According to the geologists of the American Museum it would seem that underlying Mongolia is an immense pre-Palaeozoic floor, probably a granite batholith, perhaps of unrivaled dimensions. Central Mongolia has formed a land mass and a long succession of continental deposits has been laid down on the surface of the plateau and in the basins, and these beds have yielded a remarkable series of fossils, notably of land animals. The wind erosion of the shallow basins is going on at the present day and has probably been in progress for ages. It is from these arid wastes of the dead heart of Asia that the winter winds bring their load of dust, which, in course of time, has built up the great loess deposits of northern China. The cliffs on the edges of the eroded basins are often grotesque in the extreme and afford beautiful examples of the erosive action of wind, frost and rain. The northern part of the desert, the grassland fringe, is completely level. Belts of sand dunes occur locally in the desert, one of the most remarkable areas being a strip 100 mi. long

but only 2 or 3 mi. wide near the northern foot of the eastern Altai. The desert vegetation consists of short wiry grass, camel sage and low thorny bushes. The only places where trees are found in the Gobi are in the few river bottoms. They are all old trees, consisting especially of elm; no sign of new growth has appeared.

In the eastern part of the desert are different tribes of the Mongolian race, and in the west some nomadic tribes of the Tatar race are found.

GOBY, a small, brightly colored fish, found along the coasts and inlets of tropical and temperate seas. The family (*Gobeidae*) includes more than 450 kinds, many of which are distinguished by the union of the ventral fins to form a sucking disk, enabling them to cling to rocks for safety. An interesting habit of some gobies is their building of seaweed nests in the spring, guarded by the male after the female has deposited her eggs. Others lay their eggs in shells, turning the hollow side downwards and covering the top with sand. The mud-skipper, or mudfish (*Periophthalmus*), of the East Indies, a goby, is able to move on shore, or on the mud flats, by means of its strongly developed pectoral fins. Shell fish and worms are favorite foods of the gobies.

GOD, the name of the supreme being. From earliest times, man has assumed that there must be some mind creating, developing and maintaining the universe where he dwells. That mind was conceived, not as a system of law but as a person exercising will according to motives in which law was no more than one element. Numerous deities were worshiped. Some were tribal, as for instance Chemosh, god of the Moabites, mentioned in Numbers 30:29. Others, in the Greek Olympus, represented forces and activities, like Aeolus, god of winds, Mars, god of war, Venus, goddess of love, Vulcan, god of fire, and Minerva, goddess of wisdom. These gods were expressed to the eye as idols and were thus adored. The Jewish Jehovah or Yahweh was God present in human life and His name has been translated I Am. In the Hebrew Scriptures, Jehovah is described as omnipotent or all-powerful; omniscient or all-knowing; infinite, or surpassing the limits of time and space; eternal or transcending human conceptions of existence. He is to be worshiped, not as an idol, made with hands, but as a Spirit of truth, justice and mercy. In I John 4:8, this religion is summed up in the majestic declaration, "God is Love." The conception of God as one and indivisible, shared by Jews, Christians and Mohammedans, is now widely diffused throughout the world and idolatry in all forms is yielding to the more enlightened faith. According to the Christian creeds, God is a Trinity of Three Persons in One, namely, the Father, Son and Holy Spirit, which mystery, Hellenic in character, is developed in the declaration attributed to Athanasius (*see* ATHANASIAN CREED). The Hebrew and Mohammedan teaching emphasizes God's unity and is similar in this respect to Unitarian beliefs in Christendom. Whatever other differences there may be, all these religions insist that, as the word in English implies, God is good, or as the Lord's Prayer expresses it, "Our Father Who art in heaven." This belief, though simple, involves questions that have never been answered, as for instance: How does a good God permit evil? And how does an all powerful God confer free will to man? The profoundest and most poetic treatment of these perplexities is to be found in the Book of Job.

GODARD, BENJAMIN (1849-95), French music composer, was born at Paris, Aug. 18, 1849. He studied at the Paris Conservatoire. In 1878 he won the Paris Municipal Music Prize with his dramatic symphony *Tasso.* His large number of symphonic works show an unusual gift for orchestration. His operas were only moderately successful, although *Jocelyn,* containing the famous "Berceuse," was well received at its première in 1888. He died at Cannes, Jan. 10, 1895.

GODETIA, a genus of annual herbs of the evening-primrose family several of which are adapted to flower garden culture. There are about 25 species native to the western parts of North and South America, 17 occurring in California. They are mostly erect plants with narrow leaves and showy red, purple, cream-color or nearly white flowers opening during the day.

GODFREY, THOMAS (1736-63), American writer, was born at Philadelphia, Pa., Dec. 4, 1736. His father was a famous mathematician. He was apprenticed to a watchmaker in Philadelphia, became a lieutenant of the force raised against Fort Duquesne, and worked as a factor in North Carolina. His *Prince of Parthia,* published in 1759, is said to be the first drama to appear in the United States. *The Court of Fancy,* probably inspired by Chaucer's *House of Fame,* came out in 1763, and his collected works in 1767. He died at Wilmington, N.C., Aug. 3, 1763.

GODFREY OF BOUILLON (c. 1058-1100), a leader in the First Crusade and the first Latin ruler of Jerusalem, was born in Baisy, Brabant, about the year 1061. He was the second son of Eustace II, Count of Boulogne, and claimed descent from Charlemagne. In 1084 he was permitted to assume the title of his grandfather, Duke of Lower Lorraine, by the emperor Henry IV. Fired with enthusiasm for the First Crusade, Godfrey sold most of his lands and possessions, mustered a force estimated by some at 40,000 and set out for the Holy Land. He led the Crusaders into Jerusalem after its fall, July 15, 1099. Chosen to be king of Jerusalem, July 22, 1099, he refused the title as unsuited to the Holy Land, and was designated Protector of the Holy Sepulcher. The period of his rule was a continuous struggle with the Arabs of Egypt and the Patriarch Dagobert. He died in Jerusalem, July 18, 1100.

GODIN, JEAN BAPTISTE ANDRÉ (1817-88), French socialist, was born at Esquehéries, Aisne, Jan. 26, 1817. Head of a foundry at Guise, he converted the entire establishment, in 1859, into a cooperative

community, with houses for workers, nurseries, playgrounds, restaurants, stores, a theater and a hospital. The entire property later passed to the workers. Godin was elected to the chamber of deputies in 1871, but retired in 1876 to give his whole time to his community activity. He was made a knight of the Legion of Honor in 1882. He wrote several socialist books (*Solutions Sociales, Mutualité Sociale, Les Idées Socialistes en France*), and his community has been the subject of books by other writers, as *Twenty-eight Years of Copartnership at Guise,* by A. Williams. Godin died at Guise, Jan. 17, 1888.

GODIVA, a Saxon lady (1040-80), the wife of Leofric, Earl of Mercia and Lord of Coventry. Godiva is famous in connection with the following legends. When her husband Leofric levied excessive taxes on the citizens of Coventry, Lady Godiva went to him and begged that the taxes be lowered; Leofric refused, saying that he would lower them only when his wife rode nude through the streets. But Godiva, undaunted, issued a proclamation that all the citizens shutter the windows, and then she rode naked through the towns. Leofric acceded to her wishes, and the only person who saw Godiva on her ride was "Peeping Tom," who was struck blind for his presumption. Lady Godiva appears in several old histories, in Drayton's *Polybion,* 1613, and in Tennyson's *Godiva,* 1842.

GODKIN, EDWIN LAWRENCE (1831-1902), American publisher, was born in Moyne Co., Wicklow, Ireland, Oct. 2, 1831, and educated at Queen's College, Belfast. In 1856 he came to America as correspondent for the London *Daily News* and in 1865 founded the *Nation* which became a leading news magazine. After selling it to Henry Villard in 1881, he served in 1883-99 as editor in chief of the New York *Evening Post.* In this position he initiated independent political policies, advocating currency reform, a tariff for revenue only, and changes in the Civil Service. He opposed Blaine for president, his efforts doing much to create the MUGWUMP party. He retired in 1899, and died in Greenway, Devonshire, England, May 21, 1902.

GODOWSKY, LEOPOLD (1870-), Russian pianist and composer, was born at Vilna, Feb. 3, 1870. He studied at the Berlin Hochschule, and later with SAINT-SAENS. He first played in public in 1879, subsequently making many European concert tours, and appearing in the United States in 1884. In 1895 he was appointed director of the piano department of the Chicago Conservatory. He has composed many piano compositions, including his *Fifty-three Studies on Chopin's Études,* which are original compositions rather than transcriptions. As a pianist he has been considered as a master of tone gradation.

GODUNOV, BORIS FEDOROVICH (1552-1605), Tsar of Muscovy, came of a famous Tartar family. He entered the court of Ivan the Terrible and became his most powerful counsellor. Boris seized the throne of Muscovy in 1598 and became one of the greatest tsars. He instituted measures to encourage English merchants to bring their goods to Russia, forbade the transfer of peasants, thus making them part of the land, sent colonists to Siberia, and ordered the Muscovite church to be on the same plane as other eastern churches. He died, Apr. 13, 1605.

GODWIN, WILLIAM (1756-1836), English political writer and novelist, was born at Wisbech, Cambridgeshire, Mar. 3, 1756. He studied for the ministry at Hoxton Academy, but gave up preaching in 1783 after holding pastorates at Ware and Stowmarket. The year preceding he had gone to London, where he became prominent in literary and radical circles. His most important work is his *Inquiry Concerning Political Justice,* 1793. Early opposed to all forms of tyranny, he soon found himself in the camp of the philosophical anarchists. His ideas on property and marriage were exceedingly unorthodox. In 1796 he attempted to carry out his ideas on marriage by entering a relationship with Mary Wollstonecraft, but the following year decided to conform for the sake of their child, the future Mrs. Shelley. With a second wife Godwin started a publishing business in 1805 but found himself bankrupt in 1822. Among his other writings are *The Adventures of Caleb Williams,* 1794, and *Saint Leon,* 1799, both novels; *Of Population,* 1820, a reply to Malthus, and *A History of the Commonwealth of England,* 1824-28. Godwin died in London, Apr. 7, 1836.

GODWIN-AUSTEN, also known as K_2, a mountain of India 28,265 ft. high, the second highest peak in the world. It is in the Mustagh range of the Himalayan system, in 35° 53′ N. lat. and 76° 34′ E. long. The peak was long marked K_2 on the Indian maps, and was named in 1888 after Colonel Godwin-Austen, its first explorer.

GODWIT, a genus (*Limosa*) of sandpipers formerly highly prized for game, found on mud flats and in grassy marshes. They are large birds closely resembling curlews but with their long bills turned slightly upwards. Well-known North American species are the marbled godwit (*L. fedoa*), formerly common in the interior and the Hudsonian godwit (*L. haemastica*), breeding within the Arctic Circle and wintering southward to the extremity of South America.

GOETHALS, GEORGE WASHINGTON (1858-1928), American civil engineer and army officer, was born at Brooklyn, N.Y., June 29, 1858. He was graduated from the U.S. Military Academy in 1880, and progressed through the grades to the rank of major-general of engineers, a post he attained in 1915. In 1907 President Roosevelt appointed Goethals chief engineer of the PANAMA CANAL project. Confronted by tremendous difficulties in problems of terrain, as well as the lack of sanitation and the presence of yellow fever, Goethals nevertheless finished the canal construction in seven years. In 1915 he became first civil governor of the CANAL ZONE. During American participation in the World War he was successively

manager of the Emergency Fleet Corporation, acting quarter-master general of the U.S. Army, and chief of the division of purchase, storage and traffic. He died at New York City, Jan. 21, 1928.

GOETHE, JOHANN WOLFGANG VON (1749-1832), the great poet of the Germans, was born in Frankfort-on-Main, Aug. 28, 1749, of well-to-do and educated parents. His talent for writing had shown itself before he was sent to the University of Leipzig at the age of 16, but it was not until 1770, when he had gone to Strasbourg to finish his legal education, that his genius fully flowered. At that period Strasbourg, although thoroughly German in its tone and Gothic in its architecture, was in the hands of the French. This ironic incongruity and an almost fortuitous meeting with Herder, who sent Goethe to Shakespeare and the early German *Volkslieder* in search of form and material, turned Goethe into a self-conscious artist, devoted to the fostering of a national literature. His first important drama, *Götz von Berlichingen,* with its hero idealized from a robber-baron into a figure of natural nobility, introduced the Shakespearean form into the German theater, and marked the beginning of the STURM UND DRANG romantics.

The years from 1771-75 were the most productive of Goethe's life. In 1774 appeared *Die Leiden des Jungen Werthers,* a semi-autobiographical novel of artistic temperament, hopeless love and suicide, which took Europe by storm, and which has its reverberations still. In the midst of this rich and fertile period, the "hereditary prince" of Weimar, young Karl August, met Goethe, invited him to the Saxon court, and in 1775 installed him there as Minister of State. In his preoccupation with the affairs of the duchy, Goethe's flood of writing dropped. FAUST, which had been begun, was laid aside, and in a decade Goethe wrote only one drama of major proportions, *Iphigenie auf Tauris,* which, with a few exquisite lyrics and the immortal *Erlkönig,* rescues the period from literary oblivion. Throughout these years Goethe was maturing his philosophy. He left behind him the romantic excesses of his earlier work, and went steadily in the direction of classical austerity and beauty. A secret holiday in Italy in 1786 showed results no less startling to his followers than his year in Strasbourg had done. *Wilhelm Meisters Lehrjahre* (*see* WILHELM MEISTER'S APPRENTICESHIP) stands in almost complete antithesis to the idea of *The Sorrows of Werther* in its advocacy of the necessity of discipline in the good life. The first part of *Faust,* 1808, might have been published as a monument to the romantic period of Goethe's youth. The completed *Faust,* with its unearthly allegory, sums up the philosophical findings of Goethe's maturity. Literature has no stranger or more incongruous masterpiece.

Goethe died in Weimar, Mar. 22, 1832. He had been statesman, scientist, artist and philosopher, as well as man of letters. He had outgrown completely the romantic school which he had helped to initiate, but since his death no artist has arisen to carry forward with any adequacy the suggestions in Goethe's later work. *See also* GERMAN LITERATURE. D. B.

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GOGOL, NIKOLAY VASILEVICH (1809-52), Russian novelist and playwright, was born in Sorochintsky, Poltava Province, Mar. 31, 1809. After finishing his elementary studies at Niezhin Gymnasium, he obtained a clerical post with the government at St. Petersburg. He gave this up, and after some feeble attempts at acting and teaching, he turned to literature for a living. Here he speedily attained that mastery that made him the most distinguished humorist and genial satirist of his age. *Evenings on a Farm Near Dikanka,* 1831, is a collection of charming tales about Ukrainian villagers filled with a characteristic humorous interweaving of the realistic and the romantic. *Taras Bulba* is a lusty story of Cossack life. *The Government Inspector,* 1836, is a celebrated comedy satirizing the provincial bureaucracy; the hero, Khlestakov, is an amusing impostor whose name is now a byword in the Russian language. *The Cloak,* 1836, is a novelette sketching the humorous and pathetic career of a humble official overwhelmed by the complexities of a cruel and unfeeling social order. *Dead Souls,* 1842, probably Gogol's masterpiece, is an unfinished novel about Russian provincial life under the system of serfdom. In his latter years Gogol turned towards mysticism and asceticism. He died at Moscow, Mar. 3, 1852.

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GOITER, a term used to indicate various diseases of the thyroid gland which are generally accompanied by a swelling in the front of the neck. A single term, however, is not properly used to designate conditions which are characterized by widely varying symptoms. Thus in some cases the enlargement of the THYROID GLAND is accompanied by symptoms indicating hyperactivity of that gland—intense nervousness, sweating, tremor, palpitation of the heart. Such a condition is more properly referred to as *hyperthyroidism.* In other cases the enlargement is accompanied by symptoms indicating hypoactivity of the gland—apathy, muscular weakness, even idiocy, the condition known as CRETINISM in its congenital form, or MYXEDEMA in its acquired form. Or the gland may become enlarged, due to the presence within it of a malignant disease such as carcinoma or sarcoma.

The variety of these conditions so loosely grouped under the name of goiter is best indicated by the following classification adapted by Dr. Allen Graham from Dr. David Marine's grouping of diseases of the thyroid gland: (1) Normal; (2) hypertrophy: (3) hyperplasia; (4) colloid goiter; (5) exhaustion, atrophy, fibrosis; (6) adenoma, benign; (7) adenoma, malignant; (8) carcinoma; (9) sarcoma; (10) inflammation.

Diverse as these conditions may appear, however, in two respects they are similar. First, they occur with the greatest frequency in certain regions of the world along the great watersheds, known as endemic goiter regions—in the Alps, Himalayas and Andes mountains, in Derbyshire, England, in the Indian Punjab, in northern Italy, and in this country especially in the Rocky Mountains and in the region of the Great Lakes. The second point of similarity is that most of these conditions, which generally result from a congenital fault in the thyroid gland, or from hyperactivity at certain periods, may be prevented.

The activity of the thyroid gland is due to the iodine containing compound which it secretes. Iodine is essential to normal thyroid activity. During periods of stress, additional iodine is required. Lack of iodine or too much iodine, therefore, may account for the conditions of hypoactivity or hyperactivity, respectively, and for the congenital faults, which may be due to lack of sufficient iodine in the mother during pregnancy. It follows that, by the proper administration of IODINE during adolescence—a period of great physical and psychic stress—and during pregnancy, endemic goiter may be prevented. Sporadic goiter, however, may occur anywhere or at any time.

Once the various conditions listed above have developed, they must be treated according to the indications in the individual case. Acquired myxedema may be successfully treated by the administration of thyroid extract. An inactive goiter may be removed if cosmetic reasons demand. The hyperactive gland may be treated by rest, general hygienic measures and by the removal of a portion of the gland, the amount of the gland to be removed depending upon the degree of hyperactivity. A malignant thyroid gland, like malignancy of any organ or tissue, should be removed if removal is possible, or it may be treated by the X-ray, symptoms of pressure being relieved by a decompressing operation.

The two important points to remember about goiter are: first, that endemic goiter may be prevented; and second, that once goiter has developed, whatever its manifestations, the treatment must be strictly individualized under the guidance of an experienced physician. G. W. C.

GOLD, a metallic element having a bright yellow color, high density and a resplendent luster; symbol Au, atomic weight 197. This metal, of specific gravity 19.3, is the heaviest substance known with the exception of iridium, platinum and osmium. It melts at about 1075° C. It possesses great malleability and ductility. It may be hammered into sheets less than 1/300,000 of an inch thick or drawn into a wire less than 1/20,000 of an inch in diameter. Gold is also an excellent conductor of heat and electricity, although silver and copper are superior in this respect. Gold is not affected by water or oxygen nor by any single acid, except selenic. It is soluble in AQUA REGIA. It amalgamates readily with mercury, and combines directly with chlorine and bromine.

While it is harde than lead, gold is far too soft for most practical purposes except the making of gold leaf, which requires the purest form of the metal. Usually, therefore, gold is alloyed with copper, silver or aluminum to increase its hardness and wearing qualities. Copper gives gold a red tinge; silver produces the various "white alloys" used by jewelers, while 1% of aluminum yields green gold. The proportion of gold in an alloy is expressed either in carats or in degrees of fineness. Pure gold is rated as 24 carats fine. Therefore, the carat value of any alloy is expressed in parts of 24. For instance, 14-carat gold consists of 14 parts pure gold and 10 parts of alloy. Fineness is stated in parts per thousand. American and German standard gold for coinage contains 9 parts of gold and 1 of copper, and is therefore 900 fine or 21.6 carat. British standard gold contains 11 parts of gold and 1 of copper; hence it is 916.6 fine or 22 carat.

Gold is mined from two types of deposits, VEINS and PLACERS. In veins, it often occurs with quartz as the NATIVE METAL, i.e. not combined with other substances. The only chemical combination found commercially is with tellurium in the TELLURIDE ores, although it alloys with silver to form ELECTRUM. Gold frequently is found intimately associated with the ORES of other metals, as copper, silver, lead, and zinc. The weathering and erosion of gold-bearing ORE DEPOSITS liberates the gold, which is washed into stream channels where it sinks to the bottom, forming placer, or alluvial deposits.

Gold is extracted in paying quantities in comparatively few districts, although it occurs in small deposits in almost every country. In 1929, out of a total world production of $403,033,049, South Africa accounted for $215,241,881. The United States was second with $42,514,300, Canada third with $39,861,664 and Russia next with a production of $20,671,835. Other important producing countries were Mexico, Australia, British India and Japan.

The amount of gold produced from the 14th century until 1850 probably did not average as much as $10,000,000 per year. The discovery of many new rich fields, together with improved methods of treating low-grade ores, greatly accelerated gold production between 1850 and 1900. This fifty-year period witnessed nearly seven billions of dollars added to the world's gold supply, nearly twice the amount contributed during the previous five-century period. Since 1901, the annual production of gold has averaged about $400,000,000. On Jan. 1, 1930, the total monetary gold stock of the world amounted to $11,072,370,000. Of this amount, the United States held $4,283,923,000. France was second with total holdings of $1,633,402,000, Great Britain third with $711,303,000, Germany fourth with $559,533,000 and Spain next, with $495,148,000. The importance of gold in the industrial arts is indicated by a consumption of $56,903,667 worth in the United States alone, during the year 1929.

For a discussion of the transmutation of base metals to gold see CHEMISTRY, HISTORY OF.

GOLD, ECONOMIC ASPECTS. Gold and silver have been the basis for nearly all currency systems, even the early ones of Greece, Persia and Macedonia. Early Europe preferred coins of silver, but many countries used both metals and the Roman Empire established a legal ratio between the two, introducing BIMETALLISM. There has been an almost constant struggle between the adherents of the two metals. Silver was more available and therefore more widely used until the gold discoveries in the Western Hemisphere in the 15th and 16th centuries, when gold became more abundant.

The relative abundance of gold during the past century, and its higher value which makes it more convenient than silver for the settlement of international accounts, has resulted in the adoption of the gold standard by most countries. This means that the monetary system is based upon a gold unit and that other coins are defined in terms of the gold unit.

Because of the preeminence of gold as a monetary standard in many countries it is now the only generally acceptable means of settling international balances. When gold is the basis of a coinage system it is the medium in which bank notes must ultimately be redeemed, and therefore bank deposits represent potential demands for gold. Bank reserves must be kept in the form of gold in order to meet this demand, and the extent of the credit which banks may issue as well as the rate of interest are largely dependent upon the gold reserve. If this is inadequate, credit will be reduced, but if it is abundant, credit will be issued in as large quantities as borrowers wish. The protection of a country's gold reserve is usually considered to be one of the principal functions of the CENTRAL BANK and many devices are used to attain that end, especially in the countries which since the World War have found it difficult to maintain their supply. *See also* GOLD STANDARD.

GOLD COAST, a British Crown colony included in British West Africa. The term Gold Coast is now generally identified with the British Gold Coast colony which stretches along the Gulf of Guinea for 364 mi. from 5° to 11° N. lat., roughly rectangular in shape, bounded west by the Ivory Coast, and east by Togoland. Area 78,650 sq. mi., fairly equally divided between Gold Coast, ASHANTI and the Northern Territories. Among many tribes the Fanti of the south and the Ashanti of the middle zone (both Akan Negroes) may be mentioned. The Gold Coast colony alone has an area of 23,490 sq. mi. The chief towns are Accra, Cape Coast Castle, Sekondi, Kwitta and Saltpond. The coast has no estuaries, and its surf is a serious drawback, only partially obviated by long breakwaters at Sekondi and Accra. One of the outstanding events, however, in the commercial history of West Africa was the opening in 1928 of the new deep-water harbor of Takoradi, a few miles south of Sekondi.

The climate on the coast is unhealthy, but is better inland away from the swamps where the country rises gradually. There is a deficiency of rain. Mining has been considerably developed, and the output of diamonds, gold, manganese and bauxite has increased in recent years.

It is estimated that there are about 180,000,000 coco trees in the colony, but the heavy crops in some areas in recent years seem to be leading to a declining yield. In 1930 the export value of coco was over $33,000,000

A permanent English settlement has been on the Gold Coast from the middle of the 17th century. For many years the region was dependent on Sierra Leone, and from 1874 to 1886 it was associated with Lagos as a Crown colony. The British-mandated area of Togoland is administered by the Gold Coast. The country received its name because of the quantities of grains of gold found mixed with the sand of the rivers. Pop. 1931, including the colony, Ashanti and protectorate, 3,121,214. The European population amounted to 3,182.

GOLD DEMOCRATS, members of the Democratic Party, chiefly in the eastern states, who opposed the party's nominee, WILLIAM JENNINGS BRYAN, in 1896 and 1900, and secured the nomination of ALTON B. PARKER for the presidency in 1904. When the national convention in 1896 nominated Bryan and committed the party to bimetallism and "SIXTEEN TO ONE," the Gold Democrats, those committed to the maintenance of the gold standard in the national currency system, held a second convention under the name of the National Democratic Party, presented a presidential ticket, John M. Palmer and Simon B. Buckner, and denounced the regular Democrats as POPULISTS. Most Gold Democrats, however, voted for the Republican candidate to ensure Bryan's defeat; Palmer's poll for the presidency was but 131,529 votes. In 1900 no separate organization was attempted, but again the Gold Democrats refused to support Bryan. After this disastrous campaign the Gold Democrats returned to the party, nominating their candidate in 1904 after a bitter fight in the national convention. The platform contained no allusion whatever to questions of money and banking; but Parker made a public statement, "I regard the gold standard as firmly and irretrievably established." With the waning of bimetallism as an issue the factions were united.

GOLD-DUST TREE, the name given to a commonly cultivated form (var. *variegata*) of a handsome evergreen shrub (*Aucuba japonica*) of the DOGWOOD family, native to eastern Asia. It is a stout plant, 4 to 15 ft. high, bearing shining leaves, 3 to 9 in. long, much splotched with yellow, small purple flowers in clusters and scarlet, berry-like fruits.

GOLDEN ASS, THE, a Latin romance of black magic and amorous adventures, by APULEIUS, 2nd century A.D. Lucius, the hero of this diverting tale, on a visit in Thessaly, is changed into an ass and condemned to undergo a variety of adventures until at last, aided by Isis, he can be restored to human form. Told with a frank delight in sensual adornment, it includes many incidental tales, of which perhaps the best known is the story of Cupid and Psyche. *The*

Golden Ass has been an extensive literary influence through the ages, having affected most notably BOCCACCIO, CERVANTES and LE SAGE.

GOLDEN BELLS, the name given to the various cultivated species of FORSYTHIA, very popular ornamental shrubs, which bear a profusion of orange yellow flowers appearing before the leaves very early in the spring.

GOLDEN BULL, the chief constitutional document of medieval Germany. It was issued by the emperor Charles IV, and confirmed by the Diets of Nuremberg and Metz in 1356. The number of electors was fixed at seven, namely the archbishops of Mainz, Cologne, and Trier, the County Palatine of the Rhine, the Duke of Saxony, the Margrave of Brandenburg and the King of Bohemia. Elections were to be held at Frankfort and decided by majority. The prince so elected was to be crowned at Aachen and his first Diet must be held at Nuremberg. Electoral territories were to be forever indivisible, succession to the lay electorships to be according to the law of primogeniture. The electors were empowered to coin money, collect taxes and maintain independent court systems. The ultimate effect of the Golden Bull was to enhance the power of the princes at the expense of the imperial power.

Until the Golden Bull was confirmed, disputes between the princes who claimed a right to vote at the elections were usually settled by the pope. In this document no mention was made of the pope's assertion of authority over the imperial elections, the inference being that Charles IV did not recognize this claim.

GOLDEN CLUB (*Orontium aquaticum*), a vigorous aquatic perennial of the arum family found in ponds and swampy places, chiefly near the coast from Massachusetts to Florida, and sometimes planted in water gardens. It has a deep rootstock from which rise long-stalked, oblong, often floating leaves, sometimes a foot in length, and a slender flower-stalk, ½ to 2 ft. long, terminating above the water in a narrow clublike spadix crowded with small bright-yellow flowers.

GOLDEN-EYE, a genus (*Glaucionetta*) of handsome diving ducks inhabiting open waters, so-called because of their bright yellow iris. The American golden-eye or whistler (*G. clangula americana*) is found throughout North America generally, breeding from North Dakota and New England northward and migrating southward in winter as far as Mexico and Florida. It is about 20 in. long, the male having a dark glossy green head, pied black and white upperparts and white underparts. This duck dives with extreme agility and flies rapidly, making a noisy whistling sound with its wings. It feeds upon aquatic animals and tender marine plants and nests in a hollow stump or tree, laying 6 to 10 pale greenish eggs.

GOLDEN FLEECE, THE. In Greek mythology, the magic fleece of the winged ram Chrysomallus, given by Phryxus to King Æetes. The fleece, hung on the branches of a sacred oak tree and guarded by a dragon, was stolen by JASON and the Argonauts, with the help of Medea, a sorceress who was the daughter of Æetes.

GOLDEN FLEECE, ORDER OF THE, one of the oldest and highest ranking European orders of knighthood, with branches in Austria and Spain. It was founded on Jan. 10, 1430, by Duke Philip the Good of Burgundy at Bruges on the occasion of his marriage to Isabella of Portugal. The fleece was chosen, perhaps, for the dual reason of its traditional connection with the heroic myth of Jason and its immediate connection with the industrial prosperity of The Netherlands. Philip appointed himself grandmaster of the order, an office which was made hereditary in his family.

After the time of Charles V the order came into the possession of the Spanish branch of the Habsburg family. When, however, Charles VI secured possession of The Netherlands after the War of the Spanish Succession, he took the archives of the order to Vienna, 1713, and declared himself to be the grandmaster. King Philip V of Spain disputed this claim and a tacit compromise was finally reached whereby two such orders, one Austrian, the other Spanish, were to be recognized. The first class of the order was bestowed only upon sovereigns, the lower classes upon members of the nobility.

The Austrian order came to an end with the downfall of the Habsburg Empire in Austria in 1918. The Spanish order was abolished in 1930 by the new Spanish Republic. The emblem is a gold fleece suspended from a gold and blue enameled flint stone mounted upon a steel "B." It bears the legend: *Pretium Laborum Non Vile,* "No mean reward for effort." The knightly robe is an elaborate costume of deep-red, purple, gold and white.

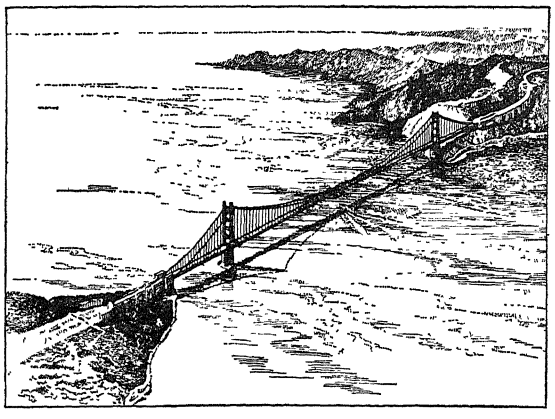
See "The Order of the Golden Fleece," *Scottish Historical Review* (Glasgow), 1908.

GOLDEN GATE, a waterway connecting San Francisco Bay with the Pacific Ocean, so-named in 1578 (?) by Sir Francis Drake. The channel is 5 mi. long and from 1 to 2 mi. wide. Bold rocky shores rise to a height of 200 ft. on the north.

GOLDEN GATE BRIDGE, a proposed bridge reaching from San Francisco to the Golden Gate. The plans call for a span longer than that of any other suspension bridge in existence in 1932. The sponsors of the Golden Gate Bridge were able in 1921 to have a bill passed through the legislature empowering the organization of the Golden Gate Bridge district with authority to issue improvement bonds as a lien against every piece of real estate in the district. After litigation, the California Supreme Court on Nov. 26, 1931, upheld the legality of a $35,000,000 bond issue. Optional contracts were awarded for the actual construction of the bridge.

GOLDEN GATE MUSEUM. The Golden Gate Park Memorial Museum of San Francisco, Calif., was made possible by the generosity of M. H. de Young, its founder, who contributed thousands of works of art as well as curios and relics. The magnificent

building of Egyptian architecture, completed in 1917, has 50 departments and 11 art galleries in which are to be viewed some of the finest pictures and statues in the country. Two entire galleries are devoted to the work of Californian artists.



THE GOLDEN GATE BRIDGE
Connecting San Francisco with Marin County to the north. From an architectural drawing

GOLDEN GLOW, a double flowered form (var. *hortensia*) of the native North American coneflower (*Rudbeckia laciniata*), very popular as an ornamental. It is a tall perennial, growing usually 6 to 10 ft. high, with a smooth much branched stem; large, long-stalked, divided leaves and very showy, bright-yellow, drooping flower-heads, 2 to 4 in. broad.

GOLDEN HORDE. A Tatar principality founded on Russian territory about 1240 by the Khan Baty, nephew of Genghiz-Khan, with his capital at Sarai on the lower Volga. The foundation of the Golden Horde marks the beginning of Russian subjection to the Tatars. As nomads, the latter did not occupy the Russian cities, but retired to the steppes, leaving behind their *baskaks,* or viceroys, with detachments of troops. They dealt with the Russian princes only through the *baskaks* or through their agents for the collection of tribute. As long as the Golden Horde was dependent on the Great Khans in Mongolia, the Russian princes were obliged to travel thither to make their submission. Early in the 14th century, Prince Ivan Kalitá of Moscow succeeded in having himself confirmed by the Tatars as Great Prince, and was entrusted with the duty of collecting tribute in behalf of the Tatar overlords. This step greatly favored the rise of Muscovite prestige. Ivan Kalitá's grandson, Dmitri Donskoi, organized a revolt against the Khan Mamai, whom he defeated in the battle of Kulikovo on Sept. 8, 1378. This revolt was avenged in blood by Tokhtamysh, Mamai's successor, who was himself overthrown by Tamerlane in 1395. Elements of disintegration now appeared within the Horde itself, which was split in 1437 by Ulu Mehmet's foundation of the separate Tatar principality of Kazan, while an independent khanate was also established in the Crimea under the Girei dynasty. In the last decades of the 15th century, the Golden Horde was exhausted by fruitless campaigns against Prince Ivan III of Moscow, and finally collapsed entirely in 1502 in conflict with the Crimean khanate.

S. H. C.

GOLDEN LEGEND, THE. 1. A 13th century collection of lives of the Christian saints, by Jacobus de Voragine. The work consists of 177 sections and is the most notable collection of its kind in existence. 2. The title of a dramatic poem by HENRY W. LONGFELLOW, 1851, based on a story by the *minnesinger,* Hartman von Aue (b. about 1170), and somewhat resembling FAUST.

GOLDENROD, the common name for a large genus (*Solidago*) of perennial plants of the composite family. There are about 125 species, natives chiefly of North America and widespread throughout the continent, though occurring in greatest variety east of the Rocky Mountains. They are found most abundantly in woodlands, prairies and fields, but thrive also in swamps, on high plains and above the timber line on mountains. They grow from a few inches to several feet in height, bearing in late summer and early autumn a profusion of small brilliant yellow flowers, usually arranged in showy, wandlike clusters. In the central and eastern states and adjacent Canada, goldenrods form a conspicuous and characteristic part of the late flowering vegetation. Various species are grown as hardy garden ornamentals, including the common Old World goldenrod (*S. Virgaurea*), the only species native to Europe. Alabama and Nebraska have chosen the goldenrod as the state flower.

GOLDEN ROSE, or Rose of Virtue, a rose of the precious metal blessed each year by the pope on the fourth Sunday in Lent and left on the altar during the following Mass. It is later sent as a mark of approbation to a royal personage or an institution. Laetare, the name of the fourth Sunday in Lent, is from the first word of the introit *Laetare Jerusalem* (Latin "Rejoice Jerusalem"), Isaiah 66:10, of the ancient Church. It is also called Mid-Lent or Mi-Careme; Rose Sunday on account of the rose color of the vestments worn that day, and Bread Sunday from the Gospel of that Sunday containing the account of the miraculous feeding of the loaves and fishes to the 5,000 followers of Christ (John 6:1-15).

GOLDEN SEAL (*Hydrastis canadensis*), a small perennial herb of the crowfoot family, closely allied to the anemone, called also puccoon, turmeric root and yellowroot. It is a native of rich woods in the eastern United States and adjacent Canada. The plant, which rises from a thick yellow rootstock, grows about a foot high bearing deeply lobed leaves and a solitary greenish-white flower. The root yields the powerful alkaloid hydrastine, related to narcotine, which is used in medicine as a digestive and nerve stimulant.

GOLDEN SECTION, a relatively recent term applied to the division of a line in extreme and mean ratio. Late Latin writers spoke of it as divine pro-

portion. A line AB is divided in extreme and mean ratio at P

P' ——————————— A P B

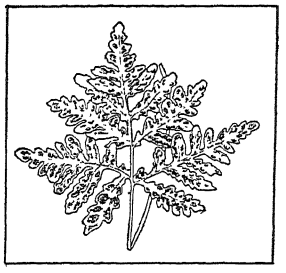
when $AB : AP = AP : PB$. It may also be divided externally in extreme and mean ratio, in which case P' replaces P in the proportion. This division was known as early as the 5th century B.C., apparently to the Pythagoreans.

GOLD EXCHANGE STANDARD, a type or form of the GOLD STANDARD, essentially without the physical presence of gold in the country. The currency (*see* MONEY) in circulation consists of fiduciary coins or paper money, redeemable on demand not in GOLD but in drafts upon a fund held in one or more foreign countries. The drafts are payable in foreign money, which, if not itself gold, is redeemable in gold on demand. The monetary unit is declared by law to contain a definite quantity of gold, as under the simple gold standard, but ordinarily no gold coins are minted. The metallic content of this uncoined gold unit determines the mint parity with foreign gold currencies, and thus the rate at which redemption takes place. As long as the currency is freely redeemable in foreign drafts payable in gold, the value of the currency cannot depreciate very far below that of its gold equivalent. The maximum depreciation would normally be determined by the cost of bringing the gold back to the country. Money presented for redemption in drafts is physically withdrawn from circulation just as though it had been exported from the country. Redemption, although it provides against depreciation, does not provide against appreciation of the unit. In order to prevent the currency from becoming so scarce that its value would rise above that of the gold it represents, provision is made whereby additional money may be put into circulation in payment of drafts drawn on the country with the gold exchange standard. Such drafts are sold abroad by agents of the country. The receipts from the sale of such drafts go into the reserve funds held abroad. Money which has been withdrawn from circulation is returned to circulation only through the payment of these drafts. Thus, the quantity of money in circulation is increased or decreased in response to the same forces which lead to an increase or decrease of currency in a country on the gold standard.

In all countries of the world gold has now practically disappeared from circulation, either because it is not available or the public no longer desires it. As a result of these variations in the gold standard, and in the gold exchange standard, the two standards approach similarity.

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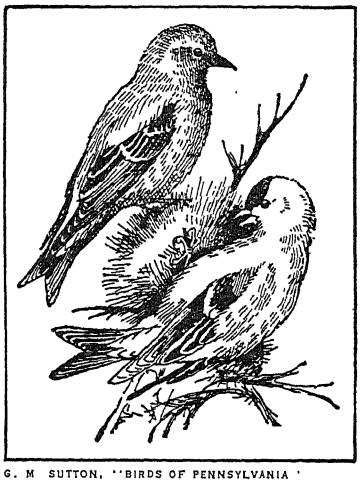
GOLD FERN (*Gymnogramma triangularis*), a beautiful fern found on damp rocks and in moist gravelly places in the Pacific coast region from British Columbia to Ecuador. It grows in dense tufts, 5 to 10 in. high, with polished dark brown leaf-stalks bearing somewhat leathery olive green leaves (*fronds*). These are more or less pentagonal or triangular in outline, usually once or twice divided into pinnate lobes. The under surface is coated with a bright-orange colored, waxy powder, sometimes varying to white, hence the name. The gold fern common in greenhouse cultivation (*G. chrysophyllum*) is a native of tropical America.



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GOLD FERN
Gymnogramma triangularis

GOLDFINCH, a genus (*Spinus*) of small American song birds of the finch family. The American goldfinch or wild canary (*S. tristis*) is a very handsome bird about 5 in. long, the male in summer having bright yellow plumage conspicuously marked with black on the wings, tail and crown. It occurs in eastern North America from southern Canada to the Gulf coast, residing the year round north of Georgia. The goldfinch moves in small flocks, with a peculiar undulating flight. It feeds upon weed seeds and in trees or bushes builds a neat cup-shaped nest, thickly lined with thistledown, laying 3 to 6 bluish-white eggs. The very sweet, ringing song of the goldfinch is canary-like in character. A related European finch (*Carduelis carduelis*), often kept as a cage bird, is also known as goldfinch.



G. M SUTTON, "BIRDS OF PENNSYLVANIA" J. HORACE MCFARLAND CO COPYRIGHT

AMERICAN GOLDFINCH
Female above. Male below

GOLDFISH (*Carassius auratus*), closely related to the Crucian carp and a native of China, where it was cultivated centuries ago, now thrives in many parts of the world. The goldfish was said to have been first brought into Europe for Mme. de Pompadour. During their centuries of cultivation, the Japanese originated many unusual types.

In a natural state the goldfish swims in shallow

ponds, where the water is warm, feeding on insects, vegetable matter, and worms. Its color is dark olive-green and all the young, even of the fancy varieties, are born this color. A few abnormal specimens develop a reddish-gold color and these have been used for breeding purposes, gradually developing into types with silver patches, and finally pure white goldfish were produced. Many monstrosities, such as those with bulging, telescope eyes, fantastic fins, and tri-lobed fantails have been created by breeders. Yet, when a fountain or pond in which domestic goldfish are living overflows and the fish have a chance to return to their wild state in a river or stream, they gradually assume their normal shape and olivaceous coloring. This explains the presence of goldfish in the Potomac River, sometimes reaching a length of 1 ft. and sold in the markets as a food fish.

Goldfish are hardy, but they are subject to a fungus skin disease when in captivity, which readily affects other fish in an aquarium. The use of fungicide cleanser is important in their care. A water plant should be in every goldfish aquarium and the water ought to be changed or freshened every few days. Spring and summer are the spawning seasons. Eggs are covered with a sticky substance, causing them to adhere to anything they touch. Fish culturists exhibit prize fish every year in Tokyo, getting as much as one hundred dollars for a beautiful pair.

GOLDIE, SIR GEORGE DASHWOOD TAUBMAN (1846-1925), British administrator and founder of Nigeria, was born in the Nunery, Isle of Man, May 20, 1846. He was given a military education, and later traveled extensively in Africa, becoming interested in the little known region of the Niger. He attended the Berlin Conference, 1884-85, as an authority on Niger questions and in 1886 his National African Company, which functioned under the name of the Royal Niger Company, was granted a charter by the British Government. The country owned by the Royal Niger Co. was purchased by the British Government in 1900. Goldie was knighted in 1887, appointed royal commissioner in the South African War and from 1905-14 and 1915-20 held the office of president of the National Defense Association. He died at London, Aug. 20, 1925.

GOLDMARK, KARL (1830-1915), Hungarian music composer, was born at Keszthely, May 18, 1830. After studying at the Vienna Conservatory he played the violin in theater orchestras, later devoting himself to composition. His reputation is based largely on his first opera, THE QUEEN OF SHEBA, produced in Vienna in 1875. He also composed a concert overture *Sakuntala,* a symphony in E flat, a symphonic poem *Zrinyi,* and two violin concertos. He died at Vienna, Jan. 2, 1915.

GOLDMARK, RUBIN (1872-), American musician, was born at New York, Aug. 15, 1872. He studied the piano under Joseffy at Vienna, and composition under DVORAK during 1889-91. In 1924 he was appointed director of the composition department of the Juilliard School of Music at New York. He has given many lecture recitals, and composed chamber music and a symphonic poem, *Samson.*

GOLDONI, CARLO (1707-93), Italian dramatist, was born at Venice, Feb. 25, 1707. Although he took his degree in law and practised briefly in Pisa, his chief interest was in playwriting. Then commenced that seemingly endless flow of comedies in the Venetian dialect and on Venetian aspects of life that made him the father of modern Italian comedy. In 1746, he was appointed composer of plays for the theater St. Angelo in Venice. In 1761 he accepted a post at the Théâtre Italien at Paris. Goldoni's importance in the dramatic history of Italy arises from the fact that he substituted for the drama of improvisation, or *commedia del arte,* a realistic comedy of character. His enormous total of 150 plays was characterized by skill in character sketching, faithful portrayal of contemporary life, dialogue full of vitality and fertility in comic invention.

His *Memoirs,* written at the age of 80, tell of a life as full of adventures as the plot of any of his plays. He died at Paris, Feb. 7, 1793.

GOLD POINTS, the points on the scale upon which the sight rates of exchange between any two gold standard countries rise and fall, at which a shipment of gold metal between the countries may take place as a private banking operation for profit. Thus, when sight drafts on London are selling at say 4.87¾ in New York, it will pay a New York bank having the necessary facilities, to export gold metal to London, either in the shape of bars or coin; 4.87¾ is then the gold export point under the conditions, in this particular rate of exchange. At about 4.84½ it will pay a New York bank to bring gold in from London, and this is the gold import point. The real explanation of a gold export from New York to London is not that when the rate for sterling drafts gets too high it is cheaper to pay debts to England in gold, but rather that the bank putting the operation through makes a profit. Whether the bank is a debtor abroad has nothing to do with the case. When demand drafts on London fall in New York to say 4.84½, it pays an operator to buy them in quantity and thus set up sterling credits in London and have these converted into gold there and have the gold shipped to New York where the amount of metal purchasable by each pound sterling will make about $4.8665. Expenses paid, this yields a slight profit, that is, if the sterling drafts can be bought as cheap as 4.84½ in New York. The gold points, as usage understands them, exist only in the exchange rates between two countries both of which are actually maintaining the gold standard and a free gold market. Such rates cannot move appreciably beyond the gold export and import points, and thus these points are noteworthy as marking the limits of fluctuation. *See also* FOREIGN EXCHANGE; GOLD STANDARD. A. C. W.

GOLDSBORO, a city and county seat of Wayne Co., eastern North Carolina, situated on the Neuse River, 50 mi. east of Raleigh. Bus lines and three railroads serve the city and there is a municipal air-

port. Cotton, tobacco and garden truck are the chief crops. Lumber products and bricks are the principal manufactures. In 1929 the value of the factory output was about $5,000,000; the retail trade amounted to $7,754,540. Goldsboro was founded and incorporated in 1847. The eastern division of the State Orthopedic Hospital and the State Hospital and the State Hospital for the Colored Insane are situated at Goldsboro. Pop. 1920, 11,296; 1930, 14,985.

GOLDSMITH, OLIVER (1728-74), Irish writer, was born probably at Pallas Co., Longford, Nov. 10, 1728, the son of a clergyman. After graduating at the University of Dublin in 1749, he made several false starts toward a profession, until he was at length sent by an uncle to Edinburgh, Scotland, to study medicine. He continued, or professed to continue, his medical studies in Leyden, Holland, made a light-hearted tour of the Continent, and returned to London in 1756, allegedly equipped to practice medicine. For three or four years he lived a hand-to-mouth existence as an apothecary's apprentice, proof reader and hack writer. He was invariably in debt, often in disgrace, but nothing damped his gay, irresponsible temperament. He published several works anonymously, and by 1761 was receiving calls from the eminent SAMUEL JOHNSON; in 1764 he was taken into the Literary Club which included among its distinguished members Dr. Johnson, JAMES BOSWELL, EDMUND BURKE, SIR JOSHUA REYNOLDS and DAVID GARRICK. Goldsmith made comparatively large sums by his writings but was so fond of entertaining, gambling and of giving his purse to unfortunates that money flowed through his fingers like water. He died of a fever in London, Apr. 4, 1774, and was buried in the Temple churchyard. Friends erected a cenotaph to his memory in Westminster Abbey.

Goldsmith's writings cover a wide range of subjects and include most of the literary mediums, whether verse, drama, essay or narrative prose. One of the earliest products of his pen was *An Enquiry into the Present State of Polite Learning in Europe,* written in 1759. Spendthrift habits and debts compelled him to produce such works as his two histories of England, *History of Rome, History of Greece, Memoirs of Voltaire, Natural Science* and his *History of Animated Nature.* As a writer on learned subjects he was fascinatingly ignorant and disregardful of truth; but, despite his faulty information, he wrote his histories, lives and memoirs with unusual clarity and charm. Goldsmith's first genuinely popular work was a series of letters, purporting to be written by an educated Chinaman in Europe to his friends at home, which appeared in 1760 in the *Public Ledger;* the letters were later published as *The Citizen of the World.* There are four great works upon which Goldsmith's fame depends. The first is a highly polished, philosophical poem, *The Traveller,* published in 1764. The second is the calm and delightful novel, THE VICAR OF WAKEFIELD, 1766. Goldsmith next published a second philosophic poem, *The Deserted Village,* 1770. Lastly there is the celebrated comedy, SHE STOOPS TO CONQUER, first produced in 1773. He was also the author of a minor comedy, *The Good Natur'd Man,* produced in 1768.

Goldsmith was an extraordinary mixture of contradictory qualities. As David Garrick said,

"Here lies Poet Goldsmith, for shortness called Noll,
Who wrote like an angel, but talked like poor Poll."

In conversation he chattered a medley of ignorance and nonsense, so that he was often the laughing stock of London. But he wrote indeed like an angel, creating gems of clear, simple prose, and in verse many lines of consummate charm and appeal. His writing flows naturally, without external ornament or affectation. It is sprightly, ironic, witty and epigrammatic without being cutting. It carries straight to the reader's heart by its charm, sincerity and genial humor. *See also* ENGLISH LITERATURE.

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GOLD STANDARD. A country which has a free gold market and whose currency is freely redeemable into gold is, technically, on the gold standard. By free gold market is meant the free importation and exportation of gold without the necessity of obtaining the permission of the government or the central bank. In post-war years the gold standard has been somewhat modified and now it frequently takes the form of what is known as the gold bullion standard. The latter differs from the former in that the central bank is not obliged to convert its notes into gold on demand, but only to exchange gold coin or bullion in certain minimum quantities for notes at a fixed price. Thus, for example, the Bank of England, before Great Britain went off the gold standard on Sept. 21, 1931, was not under a full obligation to redeem its notes in gold but was legally required only to sell gold at £3 17s 10½d an ounce in minimum quantities of 400 ounces.

The so-called GOLD EXCHANGE STANDARD is based on the same principles as the gold standard except that FOREIGN EXCHANGE on countries on the gold standard is considered the equivalent of gold and may be included as part of the metallic reserves of the central bank. The central bank as a rule has the option of redeeming its notes either in gold or in foreign exchange.

From an international point of view, gold acts as the common denominator of the currency systems of all countries on the gold standard. It is a commodity which is fully acceptable in the settlement of debts and which has a definite fixed price in all these countries. Thus, gold has an equalizing effect on exchange rates, on interest rates and on prices in the different countries. Since the import and export of gold is free and unrestricted under the gold standard, the movement of the exchanges of countries on the gold standard is limited by the so-called upper and lower

gold points (*see* GOLD POINTS). The difference between the gold parity of a currency and the gold points represents the cost of shipping gold from one country to another. For example, in 1931 the par value of the French franc was 3.92 cents U. S. currency, and the upper gold point, or the point at which it became profitable to export gold from the United States to France was approximately 3.95 cents while the lower gold point was about 3.89 cents. The gold points are not definitely fixed but vary depending chiefly upon the time the gold is in transit and the prevailing rates of interest.

Under the gold standard as it existed before the World War, and to a limited extent in the post-war period, an increase in interest rates in one country led to an inflow of funds from countries with lower rates of interest. This in turn strengthened the exchange of the first country and ultimately led to an inflow of gold. The increase in the stock of gold broadened the credit base of the country, interest rates tended to decline, prices to increase, exports declined and imports increased. Thus, through the mechanism of the gold standard and international movement of gold, not only were interest rates in the leading countries kept at approximately the same level but also the movement of international commodity prices was more or less uniform.

The gold standard, in order to work effectively, presupposes stable economic conditions; adjusted international accounts of the various countries; a strong banking system which is able to command credit abroad whenever needed; and a central bank in a position to regulate the movement of the exchanges and of credit.

Although in post-war years, a number of countries returned to the gold standard and their currencies represented a certain quantity of fine gold, the operation of the gold standard, in its broader meaning, has been greatly restricted, because of tariff barriers (*see* CUSTOMS DUTIES) with which the various countries have surrounded themselves and which have hampered the international movement of commodities; the economic and political uncertainties which restricted the international movement of funds; and the stabilization of gold practiced by the Federal Reserve Banks (*see* FEDERAL RESERVE SYSTEM) and the Bank of France, which to a considerable extent offset the effects of an inflow of gold. M. N.

GOLDTHREAD (*Coptis trifolia*), a beautiful perennial plant of the crowfoot family native to damp woods from Newfoundland to Tennessee and extending north-westward to Alaska. The smooth tufted stems, 3 to 6 in. high, and the small evergreen leaves rise from a thread-like, very bitter, yellow rootstock. The tiny white flowers are borne singly or in pairs on a slender stalk. A high percentage of berberine is contained in the dried rootstocks which are used in medicine as a tonic.

GOLF, a game played by striking a small ball with a club, the latter having a shaft to which is attached a head of either wood or metal, over a course (*See* GOLF COURSES.) of 9 or 18 holes. The object of the game is to drive the ball into the holes with as few strokes as possible. History fixes no definite date for the origin of golf, nor is there universal agreement on the land that gave it birth. The earliest mention of the game under that name is contained in a statute of James II of Scotland in 1457 that "golf be utterly cryit doune and nocht usyt." The reason for the king's action was that golf was being indulged in to the detriment of archery and other sports useful in the defense of the realm. Prior to that there were continental games in which a ball was struck with a club, and some historians are inclined to claim that one of these was brought into Scotland. However, it seems fair to credit Scotland with having given actual form to the game which has come up to the present times, even if the Scots did not invent it outright. Certainly it has been played there for more than five centuries. It has undergone a slow process of evolution from the time Scotch shepherds are supposed to have amused themselves by knocking round pebbles into holes in the ground with their crooks; but the general idea of the game then was much the same as now.

General Rules. The ball is struck from a given starting point, called a teeing ground, to a definite destination, the same being a hole in the ground within the limits of a closely cut specially prepared grassy surface, known as the putting green. Teeing ground, putting green and the distance intervening between the two constitute a unit of play, or a hole. The term "links" derives from the fact that, in its early days in Scotland, golf was played largely on the waste land, or links land, lying between the ocean front and the arable land further from the water line. Strictly speaking, a links is a seaside course; but by usage, especially in America, course and links are coming to be synonymous terms.

The basic rule of the game is that once the ball is struck from the teeing ground, it shall be played where found and not touched by hand until it has been played into the hole. However, the game's gradual development has resulted in the introduction into the playing regulations of numerous exceptions to this basic provision. There are two basic methods of reckoning results of play, viz., match play and stroke play. In the former each hole of the course is a separate medium of competition, and the player who holes his ball in the smallest number of strokes at the most holes wins. In stroke play, the player who holes his ball in the smallest number of strokes for the round is the winner.

Land on which the course is built is divided by rule into three general classifications, namely, through the green, hazards and putting green. Through the green, which includes all space over which the ball is played from the teeing ground to the putting green except hazards, is divided into fairway and rough. The former is a strip extending between the tee and putting green on which the turf is specially treated and maintained for the purpose of provid-

ing a fair lie for the ball. Spaces on both sides of the fairways not so treated are rough. But rules for play through the green make no distinction between fairway and rough.

History of the Ball. In the earliest days of golf in Scotland, the ball consisted of a leather covering stuffed with wet feathers. After the cover had been filled to its capacity, the seams were sewed together and the ball boiled in water. This ball continued in play until around 1848 or 1849, when it was succeeded by another made of solid gutta percha. The so-called guttie survived for 50 years. Then in 1898 Coburn Haskell, a retired American business man, conceived the idea of making a ball of rubber. This ball was made by winding a rubber thread around a core of the size of a small marble until it reached the size of approximately one and one-half inches in diameter. Over this was compressed a tough covering of balata. This ball did not actually come into general use until the first years of the 20th century, and is still the one used to-day.

Strangely enough nowhere in the records of the development of golf does there appear any reference to a standard sized ball until 1921. At a conference between the Royal and Ancient Golf Club of St. Andrews, the governing body of British golf, and the United States Golf Association in the spring of 1920, it was decided to adopt standard specifications, or at least limitations for the making of balls. These limitations were that the ball was not to weigh more than 1.62 ounces avoirdupois, nor to be less than 1.62 inches in diameter. A change in the limitation in the United States became effective Jan. 1, 1931, the size being enlarged to 1.68 inches and the weight decreased to 1.55. This action was not endorsed by the Royal and Ancient Club of St. Andrews.

Organization of Clubs. To revert to the early development of the game, whereas records of play date back to the middle of the 15th century, it was not until around the middle of the 18th century that the organization of clubs began. The Honourable Company of Edinburgh Golfers, founded in 1744, appears to have been the first. The Edinburgh Burgess Golfing Society claims foundation in 1735, but there is no documentary evidence to support the claim. The oldest minutes of the club bear date of 1773. Claims have been advanced that the Blackheath Golf Club was founded in 1608; but no record remains of any activities on the part of this club previous to 1787. James VI, later James I of England, kept his court at Greenwich close to Blackheath, and he is known to have been a devotee of golf, so that this may have given rise to the claim of earlier foundation of the club.

It was not until the second half of the 19th century that golf began to acquire any popularity in England. Prior to that Scotsmen who had come down into the land had played at the game around London and other populous centers; but it was not until the last quarter of the century that English-born players were developed to contest the supremacy of the Scots. The first Englishman to win a championship was John Ball of Liverpool, who first won the British Amateur Championship in 1888. Incidentally the British Open Championship was first contested in 1860 and the British Amateur 25 years later.

Development in America. As far back as the late years of the 18th century mention of golf appears in publications of the times in the United States. The Charleston (South Carolina) *City Gazette,* dated Oct. 13, 1795, announced the approaching anniversary of the golf club on the village green. Similarly, the Georgia *Gazette* of Sept. 22, 1796, published at Savannah, published notice of the meeting of the Savannah Golf Club to be held at the Merchants and Planters Coffee House. But even prior to the foregoing, the Rivington *Royal Gazette* of Apr. 21, 1779, published in New York, announced that golf balls and clubs could be purchased from the printers of that publication. However, in no case has there been found any definite mention of the actual playing of the game.

It was well on toward the close of the 19th century that golf took a definite hold in the United States. In 1884 a small group of men who had settled in Greenbrier County, W.Va., near White Sulphur Springs, laid out a 9-hole course on the property of Russell W. Montague, a New Englander who had spent some time in England and Scotland and had played golf there. The others were transplanted Scots. Five of them organized what was called the Oakhurst Golf Club. Montague's home served as their clubhouse. This appears to have been the first actual golf club organized in the United States. But its development went no further. Inhabitants of the section took no interest, and in due time the little group broke up and the club passed out of existence.

Meantime, in the early '80s other scattering attempts at the game were being made. Col. J. Hamilton Gillespie, a young Scot, located at what is now Sarasota, Fla., as the manager of a land syndicate. He brought golf clubs and balls, and in due time played the game on improvised ground there. Similar individual experiences have been claimed for other localities. But it seems quite certain that the St. Andrews Golf Club, now located at Mt. Hope north of the city of Yonkers, was the first golf club organized as a golf club and continually in existence since then in the United States. Its inception is credited to the activities of a Dunfermline linen merchant, Robert Lockhart by name, who had come to locate in New York. Lockhart brought over with him on one of his trips a supply of clubs and balls. He tried them out in Central Park, but was arrested by a policeman for disorderly conduct. He interested his friend John Reid of Yonkers in the game, who in turn helped in recruiting other enthusiasts, and in Nov. 1888 they organized the St. Andrews Golf Club of Yonkers. They played first on the 20 to 30 acre farm of H. O. Tallmadge, one of the members, the course consisting of six holes. In 1892 they moved to Palisades Ave., Yonkers, where another six-hole course was constructed. On this lat-

ter, it was customary for the members to meet around an apple tree near the first tee, on whose branches members hung their surplus clothing and the like, from which the organization came to be known as the Apple Tree Gang. The club moved to its present location at Mt. Hope in 1897.

In 1891 the Shinnecock Hills Golf Club was organized on the south shore of Long Island, some five miles west of Southampton. It was the first golf club in the country duly chartered. St. Andrews was not chartered until 1895. Likewise Shinnecock Hills was the first club to have its own clubhouse designed and built for that purpose. The Chicago Golf Club, organized shortly after Shinnecock Hills, was the first to have a full 18-hole course, its course being opened for play in 1893. The United States Golf Association was organized Dec. 22, 1894 with five clubs as members; St. Andrews Golf Club, Newport Golf Club, Shinnecock Hills Golf Club, Chicago Golf Club, and The Country Club of Brookline. The first official Amateur Championship was played the following year, likewise the first Open Championship. The first championship for women was held in 1896. From this start the game began to attract interest in various parts of the country in the next few years. By 1900 there were approximately 400 clubs in the country. During the summer of 1900 interest in the game was increased through the visit here of Harry Vardon and J. H. Taylor, two of the most famous of British professional players, who played a number of exhibition matches in different sections of the country.

Championship Games. Four years after the appearance here of Vardon and Taylor, Walter J. Travis, an Australian by birth, who had come to this country several years before, and had taken up golf here in the late '90s, went over and won the British Amateur Championship. This too served to increase greatly the public interest. Nine years later Francis Ouimet, a young Boston Amateur, tied with Harry Vardon and Ted Ray, another famous British professional, in the United States Open Championship, and then defeated both of them in a play-off. It has often been said that Ouimet's startling victory for the first time in the United States made golf first-page newspaper news. In 1930 Robert T. Jones, Jr., a young Atlanta attorney and amateur golfer, achieved the almost incredible record of winning the British Amateur and Open Championships and the United States Amateur and Open Championships. In 1932 Gene Sarazen, American professional, won the British Open Championship with a record breaking total score of 283, and the United States Open Championship with 286.

Golf is played now in almost every country on the face of the globe. Practically every state in the Union has its own golf association and holds its annual championships. Interest in the game on the part of women players has developed almost in proportion to that of men. Accurate figures on the number of players have never been compiled, but it is conservatively estimated that there are approximately 4,000,000.

In a business way the game has come to be a real industry. Approximately 22,500,000 new balls were sold in America in 1930, in addition to a large number of damaged balls that were reclaimed and put back into play. No accurate figures are available on the number of clubs sold; but the bill for new balls, clubs and other implements for the year 1930 approximated $50,000,000. Annual dues of clubs members exceed $20,000,000. The valuation of the properties occupied by clubs including courses and club houses, runs into the hundreds of millions. It is rather a far cry from the first humble efforts of the Scots among the dunes along the seashore. I. B.

GOLF COURSES, the prepared outdoor stretch of country, sometimes called links, on which "the Royal and Ancient game of golf" is played. There were courses in Holland as early as the 17th century, as indicated in canvasses by Dutch painters of that period showing putting at a hole in the ground. Scotland was chiefly instrumental in pointing the development of the golf course toward its present design. After 1880, when the game began to arouse enthusiasm in the United States, American architects made substantial contributions to the topographical problems involved in laying out golf courses. There now exist certain definite rules in the construction of courses, and these stipulations are recognized internationally. From year to year, however, new regulations aimed at improving courses are made by golf associations the world over.

Golf courses fall into two dimensions, the 9-hole course and the 18-hole course. The former was first designed for women players, or was restricted to the smaller number of holes because of economic or other considerations. The present article deals with 18-hole courses, which enjoy the greatest popularity. The ideal course should be between 3 and 4¼ miles round, over an undulating reach of country providing crisp turf, a generous degree of hillocks, ponds, trees, bunkers or sand-holes, and ruts to form natural hazards. A good average length course is 6,000 yards. There must be plenty of space in which to build a greater or lesser number of artificial bunkers, depending upon the character of the land. In this open area the golf architect plots 18 holes. The distance between the holes is determined by the area of land available; but general practice puts the minimum distance at 100 yards, and the maximum at 500 yards. The hole, which is 4½ inches in diameter and 6 inches in depth, is placed in the approximate center of the putting-green, a space 60 feet square, made smooth by rolling and mowing. The player drives his ball from the teeing-ground or tee, a small, sandy and smooth elevation. A conventional hole requires two long drives from the tee, or a drive and an iron shot, to reach the putting-green, unless the player drives off the fairway into the rough or encounters a bunker, water-hazard, or other trap. A flag set into the hole indicates the general direction of the next green. A good drive from the tee is 200 yards.

The most celebrated golf course is that at the historic club of St. Andrews at Fifeshire, Scotland. Other English courses, made famous by cup play, include

Westward Ho! and Sandwich. Among well-known courses in the United States may be mentioned the links at Baltusrole, Short Hills, N.J., and the Inwood course on Long Island. In 1931 the files of the U.S. Golf Association represented 5,856 private golf courses, of which 2,414 were 18-hole links. The investment in courses was $852,891,408, or an average of $145,644 per course. In addition, municipal courses in 1927 numbered 200, a total which was more than doubled by 1930. The average annual cost of maintaining a private 18-hole course is $15,000. *See* GOLF.

GOLGI, CAMILLO (1844-1926), Italian physician, histologist and neurologist, was born at Corteno, July 7, 1844. After studying at Pavia he practiced at Abiategrasso until 1865, when he became professor of anatomy at Siena. In 1876 he became professor of histology and in 1881 professor of pathological anatomy at Pavia. Using silver nitrate as a stain, in 1870 he began his researches into nerve tissue, which terminated in the proof of an interlacing nerve system, where previously a nerve net had been assumed. Nerve cells in the spinal cord, the organs of Golgi, were named for him. In 1906 he divided the Nobel Prize in medicine with Cajal. He died at Pavia, Jan. 21, 1906.

GOLIATH, in Biblical narrative the Philistine giant whom David slew as recorded in I Samuel 17. By this episode, whereby the Philistines lost heart and were easily dispersed, David became a popular hero. This miraculous victory awakened Saul's jealousy and prompted him to seek David's death. Although this conflict with Goliath is one of the most celebrated incidents in David's life, the legend itself is not confined to Biblical literature. An old Egyptian tale, appearing about 2000 B.C. and woven about a Bedouin hero, has many points of resemblance to the story of David and Goliath.

GOLLANCZ, SIR ISRAEL (1864-1930), English scholar, was born in London, July 13, 1864. He was educated at University College, London, and at Cambridge. From 1896 to 1906 he was University Lecturer in English at Cambridge, having previously lectured at King's College, London. His work as a scholar includes editing the *Temple Shakespeare,* 1894-96, the *King's Library* series, the *Temple Classics,* and compiling the *Exeter Book of Anglo-Saxon Poetry,* 1895. Gollancz was knighted in 1919. He died at Hampstead, London, June 23, 1930.

GOLTZ, COLMAR (Freiherr von Der) (1843-1916), Prussian general and military writer, was born Aug. 12, 1843, at Bielkenfeld, near Labiau. He took part in the wars of 1866 and 1870, and was on the general staff since 1868. From 1883 to 1896 he was temporarily in the service of Turkey in charge of military instruction and again from 1908 to 1910, to reorganize the army. He was made general field marshal in 1911. In 1914 Goltz was made military governor of the occupied territory in Belgium, and the following year he led a Turkish army in Mesopotamia and encircled General Townshend's British forces. He died April 19, 1916, at Bagdad.

GOMEL, administrative center of Gomel district, in the White Russian S.S.R., western Russia. It is picturesquely situated on the right bank of the Sozh River, among forests and swamp lands. Along the ancient road running southward from KIEV, it is a railroad center and a landing place for steamers from Kiev and Mogilev. It dates from the 12th century. Formerly Polish territory, Gomel became Russian property in 1772, and was the privately owned town of Field Marshal Rumiantsev, who built two fine churches which were standing in 1931, and a castle, now the State Historical-Art Museum. Lumber and foundry products are among the manufactures of the city. Pop. 1926, 86,393.

GOMER, in Biblical account, the son of Japheth (Genesis 10:2-3) and the father of Ashkenaz, Riphath and Togarmah. The sons of Gomer have been identified by scholars with the tribes representing the Homer Cimmerians, and Assyrian inscriptions mention the *Gimirrai* as invading Asia Minor and overrunning Lydia about 700 B.C. It is interesting to note in this connection that the Armenians call Cappadocia Gamir.

GOMERA. *See* CANARY ISLANDS.

GÓMEZ, ENRÍQUEZ ANTONIO (c. 1602-c. 1662), Spanish poet and novelist, known also as Enríquez de Pa, was born about 1602, probably at Segovia, the son of a converted Jew. After extensive military service, he settled in France. There he could write without further molestation from the Inquisition, which, unable to capture him, burned him in effigy in an *auto da fe.* His picaresque tales of *Estebanillo González,* 1646, are clever, amusing and improper. He also wrote 22 comedies and some religious epics. Gómez died about 1662.

GOMEZ, JUAN VICENTE (1864-), Venezuelan statesman. Gomez came into power by a *coup d'etat* in 1909 while the dictator, Cipriano Castro, was in Europe. A new constitution was framed in 1909 and Gomez became constitutional president in 1910. He put down two revolts in 1913. In 1914 a new document, drawn up by him, provided for a constitutional dictatorship, but another more to his liking was adopted in 1922. Gomez governed directly, or through his headship of the army. In 1925 another constitution was promulgated. Though Gomez was virtually illiterate he preserved peace and paid off the foreign debt of the nation, in the prosperity of which the discovery of oil was an important factor. In 1929 he was reelected but refused to serve, though in 1931 he assumed direct power again. Gomez devoted much attention to enhancing the attractiveness of Venezuela for tourists.

GOMEZ DE AVELLANEDA, GERTRUDIS (1814-73), probably the most gifted of Spanish or Spanish-American women poets, was born in 1814, in Camaguey, Cuba. At 22 she went to Spain, and her reputation, indeed, belongs to the mother country. Her first verses were published in 1839, and the following year she became a leading literary figure of Madrid. Of her dramas, *Baltasar,* is regarded as her masterpiece. Her first novel, *Sab,* has been called

the *Uncle Tom's Cabin* of her day; the story of a mulatto slave, it is a ringing protest against black slavery. La Avellaneda revisited Cuba in 1860, but returned to Spain after the death of her second husband in Havana. She died in 1873.

GOMEZ DE LA SERNA, RAMON (1891-), Spanish humorous writer, was born at Madrid, July 5, 1891. He finished his legal studies at the age of 17, but decided to devote himself to literature. His output is extremely varied and voluminous, including novels, short stories, plays and criticism. Many of his articles, and even some of his novels, are known under the generic name of Greguerias. His *Movieland* was translated into English in 1930.

GOMEZ PALACIO, a city of north central Mexico, situated in the state of Durango, on the Nazas River, about 155 mi. from the city of Durango, and 4 mi. from Torreon, at an altitude of 3,725 ft. above sea level. It lies in the edge of the great *Laguna* cotton belt, where, in good seasons, 100,000 bales of cotton are produced yearly. It is connected with Torreon by electric street cars and a bus line over a well-paved highway. The city has a power plant owned by an American company which serves a number of neighboring towns, a sewerage system and one of the largest soap factories in Mexico. This factory utilizes a good part of the cottonseed oil produced in the district. Gomez Palacio was named for the statesman, Palacios, of Durango City, who was ambassador to the United States at the beginning of the revolution of 1910. Pop. 1930, 46,519.

GOMORRAH. *See* SODOM AND GOMORRAH.

GOMPERS, SAMUEL (1850-1924), American labor leader, was born in London, England, Jan. 27, 1850. Beginning work at 10 years of age, he learned the cigarmaker's trade. He came to the United States with his parents in 1863, and a year later in New York City he joined the Cigarmaker's Union. Eager to learn, and seriously interested in the problems of labor, he attended lectures at Cooper Union, read constantly, and talked with his fellow laborers while at work. He was a leader in the reorganization of the Cigarmakers' Union in 1877, the organization of which became a model for other American unions. In 1881 the Federation of Organized Trades and Labor Unions was formed with Gompers as chairman of the committee on constitution and it was this committee which shaped the final plan of organization. The Federation was reorganized in 1886 as the National Federation of Labor with Gompers as president, and except in 1894, when the Socialists defeated him, he was reelected annually until his death. As leader of the American labor movement he shaped its policies. He upheld unionization by crafts, opposed the formation of a Labor Party, worked tirelessly for beneficial labor legislation, fought against Socialism, the I.W.W., and all radical movements. He did on occasion urge labor to vote for candidates who were sympathetic to labor, La Follette for president in 1924 for example. Though opposed to armed conflict, he strongly supported the United States Government in the World War, and was appointed by President Wilson a member of the Advisory Commission of the Council for National Defense. He represented the A. F. of L. at the Peace Conference in Paris, and was Chairman of the Peace Conference Commission on Labor Legislation. He was an advocate of the League of Nations, and the room furnished by the American Federation of Labor in the International Labor Office bears a memorial to him. He died at San Antonio, Tex., Dec. 13, 1924.

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GONCHAROV, IVAN ALEXANDROVICH (1812-91), Russian novelist, was born at Simbirsk, July 18, 1812, and was educated at the University of Moscow. In 1856 he acted as secretary to Admiral Putiatin in negotiating a commercial treaty with Japan. The well-known *Frigate Pallada* shows the influence of this Eastern journey. Goncharov's masterpiece is undoubtedly *Oblomov,* 1857, a novel that is essentially a study of irresolution in man; Oblomov, the hero, is typically Russian, finding it impossible to act out his decisions. The Russians have coined the word *Oblomovism* to indicate the national defect. *The Precipice,* 1868, deals chiefly with the social types appearing in the transition period between the old and the new. Also worthy of note is the novel, *A Common Story.* The famous creator of Oblomov died obscurely in Sept. 1891.

GONCOURT, the name of two French brothers, noted as men of letters. The elder brother, Edmond Louis Antoine Huot de Goncourt (1822-96), was born at Nancy, May 26, 1822, and died at Champrosay, July 16, 1896. The younger brother, Jules Alfred Huot de Goncourt (1830-70), was born in Paris, Dec. 17, 1830, and died in Paris, June 20, 1870. Their fraternal affection was such that they wrote always in collaboration, producing the novels *Charles Demailly,* 1860, *Soeur Philomène,* 1861, *Renée Mauperin,* 1864, *Germinie Lecerteux,* 1865, *Manette Salomon,* 1865, and *Madame Gervaisais,* 1869; also several studies of the 18th century in French history and art, including *L'Art du XVIIIe Siècle,* 1859-75. Their *Journal,* in nine volumes and published in 1887-96, is also valuable as an intimate history of their time. Above all impressionists, presenting pictures of life in its intimate, small but significant details, in a kind of a visual realism, the Goncourts exercised a great influence on late 19th century literature and on the French language itself. The Academy Goncourt, with 10 members and an annual prize to the author of a notable French work of fiction, was established under the will of Edmond de Goncourt.

GONDOLA CAR. *See* RAILROAD ROLLING STOCK.

GÓNGORA Y ARGOTE, LUIS DE (1561-1627), Spanish poet, was born at Cordova, July 11, 1561, and educated at the University of Salamanca. He early announced that he would not follow law, but would be a professional poet. In 1585 Cervantes called him "a rare and matchless genius." His highly metaphorical, elaborate style was a kind of Spanish

EUPHUISM. His skill as a craftsman and his talent for satire were extraordinary, and though imitators might copy his "Gongorisms," in wit and startling ironic effect Góngora had no equal. The poet died at Cordova, May 23, 1627.

GONIOMETER, in mineralogy, a device for measuring the angles of crystals. Goniometers range in complexity from the relatively crude contact-type, resembling a pair of compasses pivoted to a graduated, semi-circular scale, still used in measuring large, rough crystals, to highly complicated, costly optical instruments. In the reflecting-goniometer, measurements are made by means of a beam of light flashed into a telescope from successive faces of a bright revolving crystal.

GONORRHEA, primarily, in most instances, an infection of the genital organs by the germ known as the gonococcus. Although the disorder is an ancient one, the germ which causes it was not discovered until 1879 by Neisser. The germs are oval in shape and usually occur in pairs. The gonococcus attacks only mucous membranes. In the male it usually gains entrance to the body through the canal in the penis. In the female it may gain entrance through the vagina or the neck of the womb. The germs may be transferred to the eyes, causing a severe type of inflammation. The eyes of the infant may be affected during passage through an infected birth-canal, the condition then being termed *ophthalmia neonatorum* (*see* CHILDREN, DISEASES OF: Diseases of the newborn).

The germs causing gonorrhea quickly penetrate through the mucous membrane on which they are lodged, to the connective tissue underneath. They multiply here quite rapidly, setting up inflammation. Pus is formed, and the mucous membrane may be eroded. The pus then flows from the surface of the mucous membrane. These effects usually appear within three to five days after infection.

In the male, the acute inflammation of the urethra, or canal through the penis, causes severe pain at the time of urination. The inflammation may spread up the urethra, and in less favorable cases the infection is carried into the prostate gland, the seminal vesicles, and the coiled tubules leading from the testis, known as the epididymis. If the epididymis of both sides is affected, STERILITY may result when the disease heals from the formation of scar tissue which shuts off the tubes. Scarring in the urethra may also result, producing narrowing of the canal, known as a stricture.

Under proper treatment gonorrhea in the male can be cured. Poor treatment may cause only an arrest of the acute inflammation, but leave a chronic infection. Early treatment consists in general measures to relieve discomfort, and later injections into the urethra to help overcome the infection. One of the chief measures in finally overcoming the disease is direct massage of the prostate gland, performed carefully and systematically. Strictures of the urethra are stretched or dilated.

In the female, the gonorrheal inflammation starting in the vagina may spread to the lining membrane of the womb. When centered there, it usually gives no noticeable symptoms. It may spread further into the Fallopian tubes, the tubes leading from the womb to the ovaries. Since the upper end of these tubes is open, the germs may get into the peritoneal cavity, or the cavity in the abdomen. The inflammation in the tubes with scarring may close up their openings and cause STERILITY. If both ends of the tubes are thus closed, pus accumulating in them causes them to swell and produces pain, fever and other signs of infection. It then becomes necessary to remove the infected tube by a surgical operation.

In the female, gonorrhea is difficult to treat and it usually runs a prolonged course.

Occasionally the gonococci get into the blood and are carried to the joints, causing a severe type of joint inflammation or arthritis. The infection may involve the heart, especially the lining of the heart and valves known as the endocardium. Gonorrhea also affects the bladder. *See* BLADDER, URINARY.

Prevention of gonorrhea is largely limited to the male. It consists in washing out the urethral canal with an antiseptic solution as soon as possible after exposure to the disease. W. I. F.

GONVILLE, EDMUND (?-1351), parish priest. Little is known about the early life of Gonville. He was the rector of Thelnethan 1320-26, of Rushworth 1326-43 and of Terrington from 1343 to his death. He was also steward to Lord Warren, 1318, and later to the Earl of Lancaster. In 1342 he founded Rushworth College and in 1349 Gonville Hall at Cambridge, England. It was Gonville's intention in founding the latter college that the main study of the fellows would be theology; but on his death his executor, Bishop Bateman, emphasized the study of canon and civil law. In 1557 the name of the hall was changed to Gonville and Caius College in recognition of the services and financial aid of Dr. JOHN CAIUS. Gonville died in 1351.

GONZAGA, THOMAS ANTONIO (1744-c. 1807), Portuguese-Brazilian poet, was born at Oporto, Aug. 11, 1744, and spent his childhood and youth at Bahia, Brazil. False political accusations caused him to be banished in 1789 from Brazil to Mozambique. His poems to his wife, *A Marilia de Dirceo,* have passed through 38 different editions, Gonzaga being probably the most popular Portuguese poet after CAMOËNS. The poet died in exile about 1807.

GONZAGA UNIVERSITY, a Jesuit institution in Spokane, Wash. The first college building was erected on land purchased in 1881 from the Northern Pacific Railroad in 1883. The university offers courses in arts, sciences, law, commerce and finance, and conducts preparatory, graduate, extension, correspondence and summer schools. In some departments it is coeducational. In 1931 the productive funds were $40,900. The library contained 27,400 books. The enrollment in 1931-32 was 981, and the faculty of 80 was headed by Pres. John J. Keep.

GONZALEZ MARTINEZ, ENRIQUE, a Spanish-American poet, was born in 1871, in Gua-

dalajara, the capital of the State of Jalisco, Mexico. In 1893 he won his physician's degree and was made an associate professor of physiology at the seminary. For 15 years he followed his calling in the State of Sinaloa, where he published his first four collections of poetry. Soon after his arrival in Mexico City in 1911 Gonzalez Martinez became President of the *Ateneo,* and in 1913 he served as Under-secretary of Instruction and Fine Arts. In the contemporary history of Spanish-American poetry Gonzalez Martinez is distinguished for his blend of the social spirit and intellectual aloofness. One of his sonnets is famous for having substituted the contemplative owl for Darío's heraldic swan (*see also* DARÍO, RUBÉN), thus indicating a trend away from preciosity and effeteness toward self-discipline and widespread education.

GONZALEZ PRADA, MANUEL (1848-1918), Spanish-American author, was born in Peru, Jan. 6, 1848. In poetry he was a critical experimenter, trying free verse, blank verse and what he called "unrhythmical polyrhythms." His prose is rich in highly effective metaphors. Gonzalez Prada ran for the Presidency of Peru on the ticket of the National Union Party, but was inevitably defeated. An enemy of the clerical faction, of Chile in its conflict with Peru, of Peru itself for its softness and subserviency, he summoned his countrymen to autonomy and endurance. He was one of the precursors of the Modernist renaissance, a determined reformer of the language, even the orthography, and the ideology of his nation and his continent. His chief books are *Paginas libres,* 1894, *Minusculas,* 1901, *Horas de lucha,* 1908, and *Exoticas,* 1911. Gonzalez Prada died July 22, 1918.

GOOCH, GEORGE PEABODY (1873-), English historian, was born at London on Oct. 21, 1873. He was educated at King's College, Cambridge, and at Berlin and Paris. In 1906-10 he was a Liberal for Bath in parliament and in 1913 for Reading. Beginning in 1911 he was one of the editors of the *Contemporary Review.* In 1922-25 he served as president of the British Historical Association. In the preparation of the *British Documents on the Origins of the War, 1898-1914,* published in 1926 and subsequently, he was one of the editors. As a student and scholar in the field of modern German history, Gooch is recognized as a leading authority on his subject.

GOODE, GEORGE BROWN (1851-96), American ichthyologist, was born at New Albany, Ind., Feb. 13, 1851. He graduated from Wesleyan University and after studying at the Harvard Museum of Comparative Anatomy he returned to Wesleyan. After serving some years upon the United States Fish Commission, he became assistant secretary of the Smithsonian Institution in charge of the National Museum. He wrote a number of books upon the life and development of fishes, upon the planning and management of museums and upon the history of scientific education in the United States. He died at Washington, D.C., Sept. 6, 1896.

GOOD FRIDAY, the Friday of Holy Week in the calendar of the Christian churches, set apart to commemorate the crucifixion of Jesus. While the name is popularly supposed to distinguish this day's fortune from the legendary bad luck of all other Fridays, it is more probably derived from a corruption of "God's Friday." It was called Long Friday by the Saxons and the Danes, apparently in allusion to the long services held on that day in the churches. In the beginning the day's observances grew out of the Jewish Passover custom of keeping "the days of unleavened bread" from the fourteenth to the twenty-first Nisan. In contrast to the long and frequent church services by which Good Friday is now celebrated, especially in Catholic churches, in medieval days, notably in Spain, the churches were closed on this day as a sign of mourning. The church services held to-day differ but slightly from each other. In all are read or chanted the Scriptures relating the passion of Christ; in Catholic churches three hour "agony" services are held in meditation on the crucifixion, or, as in many Protestant churches, sermons are preached on the seven last words from the cross. Of recent years, even nonepiscopal churches observe the day with services of prayer and meditation.

GOOD HOPE, CAPE OF, a promontory at the southwestern extremity of south Africa, having Table Bay on the west and False Bay on the east. It is a projection of Table Mountain which rises nearly 1,000 ft. above sea level. CAPE TOWN is situated on its western coast. This headland was first seen about 1488 by the Portuguese navigator, BARTHOLOMEU DIAS, who, according to the legend, named it *Cabo Tormentoso* or Stormy Cape. Nine years later, in 1497, VASCO DA GAMA rounded the cape and sailed on to the Indian peninsula. John II, king of Portugal, who considered that its discovery promised good hope of finding a water route to India, renamed it *Cabo de Boa Esperança* or Cape of Good Hope.

GOOD HOPE, CAPE OF, province. *See* CAPE OF GOOD HOPE.

GOODHUE, BERTRAM GROSVENOR (1869-1924), American architect, was born at Pomfret Hill, Conn., Apr. 28, 1869. He studied in the office of various architects, later becoming a partner in the firm of Cram, Goodhue & Ferguson. In 1914 he opened his own office. He was one of the leaders among the architects who, while inspired by the Gothic, did strikingly modern work. His outstanding achievements are the church of St. Thomas in New York City, and the State Capitol with its 400-ft. tower, at Lincoln, Neb. Among his other important buildings are the church of St. Vincent Ferrer, New York; the National Research Council building and National Academy of Sciences, Washington; the Baltimore Cathedral; Mandel Hall, University of Chicago; and the California Institute of Technology, Pasadena. He died in New York City, Apr. 24, 1924.

GOODNOW, FRANK JOHNSON (1859-), American educator and legal scholar, was born in

Brooklyn, N.Y., Jan. 18, 1859. He studied at Amherst and Columbia law school and later at the École Libre des Sciences Politiques, Paris, and in Berlin. In 1883 he joined the faculty of Columbia, where in 1891 he became a professor and from 1903-13 was Eaton professor of administrative law and municipal science. As a recognized authority on municipal and constitutional law Goodnow was asked in 1906 to examine municipal ownership experiments in Europe. The Chinese republic engaged him as legal adviser in 1913-14, and in the latter year he became president of Johns Hopkins University. He resigned in 1928. His important writings include *Comparative Administrative Law,* 1893; *Politics and Administration,* 1900; and *City Government in the United States,* 1904. He edited among other books *China: an Analysis,* 1926.

GOODRICH, SAMUEL GRISWOLD (1793-1860), American writer of juvenile books, whose pen name was "Peter Parley," was born at Ridgefield, Conn., Aug. 19, 1793. He became a publisher in Boston and was known as a patron of young writers. In 1828-42 he edited an annual, *The Token,* in which Nathaniel Hawthorne's *Twice Told Tales* first appeared. He published also a popular series of educational books for children, nearly 200 in number, which he himself wrote and compiled. Goodrich died in New York City, May 9, 1860.

GOOD SHEPHERD, INSTITUTE OF THE, a cloistered order devoted to the spiritual and temporal care of penitent girls and women, as well as unwilling subjects committed for delinquency by parents or the State. The Institute provides shelter also for women exposed to vicious or criminal influences. They form three separate classes: penitents, magdalenes and preservates, each completely segregated from the others. Many choose to remain as part of the community, taking vows under the Rule of the Third Order of Mount Carmel. Originally part of the order of "Our Lady of Charity of the Refuge," founded at Caen, France, in 1641, by St. John Eudes, the Institute became an independent branch in 1835 under the title, "Religious of Our Lady of Charity of the Good Shepherd of Angers." The rule is that of St. Augustine and the Constitutions resemble those of the Visitation Order. Good Shepherd convents are of world-wide distribution, with centralized government at Angers, France; there are 305 houses and about 9,300 religious. Among their establishments are industrial homes and orphan asylums.

GOODSPEED, EDGAR JOHNSON (1871-), American educator and Greek scholar, was born in Quincy, Ill., Oct. 23, 1871. He studied at Yale, Chicago University and at Berlin, and in 1898 joined the faculty of Chicago University as a lecturer. In 1915 he became professor of Greek and the Bible, and from 1920-24 acted as secretary to the president. Goodspeed was chosen chairman of the New Testament department in 1923. With E. D. Burton he wrote *Harmony of the Synoptic Gospels,* 1917, and in 1923 published his *New Testament,* translated from the original Greek into the language of everyday American life. His argument for this version was that the original books were written not in classical Greek but in the vernacular. The book caused wide comment but was not sympathetically received.

GOOD TEMPLARS, INTERNATIONAL ORDER OF, a society founded in 1851 for the purpose of furthering the cause of prohibition and total abstinence from the consumption, manufacture, and sale of alcoholic beverages. European branch lodges were organized after 1868, gradually spreading to all parts of the civilized world and a grand lodge was established in England in 1870. Men, women, and children are admitted to membership, though juveniles have special branches. In 1910, there were more than 400,000 members but the number has dropped to about 12,000. The Prohibition party formed in 1869 and the WOMAN'S CHRISTIAN TEMPERANCE UNION were off-shoots of this society.

GOODWILL, an asset not properly shown on the books unless it has been evaluated by purchase, as at the time of sale of a part or entire interest in a business, or upon reorganization. The basic test for goodwill value is the ability of a given business to earn higher than normal profits. Hence, the existence of goodwill is evidenced by the PROFIT AND LOSS STATEMENT rather than by the BALANCE SHEET. The owner of a business earning above normal profits manifestly will not sell it for its BOOK VALUE but will demand a bonus called goodwill which will be the measure of this above-normal earning ability. Such measure is sometimes a round amount but more often is stated as so many times the average net profit or above-normal profits, for several years. Other methods of valuation are sometimes met. R. B. K.

GOODWIN, WILLIAM WATSON (1831-1912), American educator, was born in Concord, Mass., May 9, 1831. He studied at Harvard and in Germany and in 1856 returned to Harvard as a tutor. Four years later he became Eliot professor of Greek and in his 40 years' tenure attained eminence as a Greek scholar. In 1901 Goodwin was made Eliot professor emeritus. His *Syntax of the Moods and Tenses of the Greek Verb,* enlarged ed., 1890, and *Greek Grammar,* rev. ed. 1924, were widely used. He died at Cambridge, Mass., June 16, 1912.

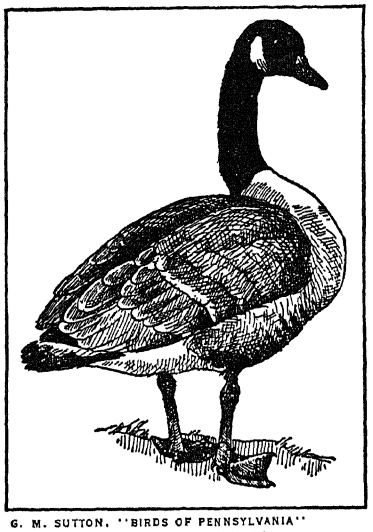
GOODYEAR, CHARLES (1800-1860), American inventor, was born at New Haven, Conn., Dec. 29, 1800. In partnership with his father who was an inventor and hardware manufacturer, he was not successful and turned to experiments with India rubber to make it resist the extremes of heat and cold. By accidentally dropping a mixture of rubber and sulphur on a hot stove, Goodyear invented the vulcanizing of rubber. He took out about sixty patents for the many new uses to which he applied the invention, but numerous infringements and lawsuits deprived him of financial success. He died in New York, July 1, 1860.

GOOSE, the name applied to an important group (*Anserinae*) of large, web-footed swimming birds closely allied to the ducks and swans. The true

geese are distinguished from the ducks by their usually greater size, longer necks and by the male and female being alike in color. Geese have longer and stronger legs than most ducks, spend more time upon land, and live more exclusively upon vegetable food. Geese differ from the swans in that the neck is shorter than the body.

Of the true geese there are some 30 species, found chiefly in the northern hemisphere. They breed usually far northward, often within the Arctic Circle, and range southward in winter as far as Cuba and Mexico. Some 10 species occur in North America, several of which migrate widely throughout the United States. They most commonly fly on dark days or by night, in V-shaped formations headed by a chosen leader, and uttering a honking cry. Like swans, geese hiss when frightened or disturbed. In color their plumage is mostly white, grayish or brown, some species with black heads and necks. The flesh of most species is highly esteemed for food.

The most widely known American wild species include the Canada goose, the blue goose, the white-



G. M. SUTTON, "BIRDS OF PENNSYLVANIA"
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CANADA GOOSE

fronted goose, the snow goose and the brant. Other important species are the gray lag goose, the bean goose and the barnacle goose of the Old World, the Andean goose of Chile and Peru and the maned goose of Australia.

The common poultry yard goose, reared long and widely for its flesh, eggs, feathers and quills, is a tamed descendant of the Old World gray lag. Its domestication, which dates from prehistoric times, was widespread in ancient Egypt, Greece and Rome. In many parts of Europe goose-raising is an extensive industry, but in the United States it is relatively unimportant. *See also* POULTRY; DUCK; SWAN.

A. B. J.

GOOSEBERRY, various spiny-branched shrubs of the saxifrage family. The European gooseberry (*Ribes grossularia*) has been developed since the 17th century into one of the most important bush fruits of northern countries, especially of Great Britain where gooseberry exhibitions are annual events, and at which specimens are often shown weighing 2 oz. These varieties are of distinctly dessert quality but hot dry summers and mildew, a parasitic fungous disease, largely prevent their successful cultivation in America.

Though several species of gooseberry are native to America, no varieties had been announced prior to 1847 when the Houghton appeared. In 1853 the Downing, a seedling of the Houghton, was introduced. Both are still grown, but the former has small fruit and is therefore much less planted. These varieties are probably offspring of the smooth-skinned American gooseberry (*R. hirtellum*) which is found growing wild in the northeastern United States and adjacent Canada. It is valuable as a cultivated fruit in Canada and other cold climates. In many states the law forbids the growing of gooseberries, because, like the currant, it is an alternate host of the pine blister rust, a fungous disease that rapidly kills the white pine.

M. G. K.

GOOSEBERRY TREE (*Phyllanthus acidus*), a shrub or small tree of the spurge family, called also Otaheite, gooseberry and jimbling. It is a native of India and Madagascar, cultivated in tropical countries for its acid berry-like fruit, which is made into preserves. The plant sometimes grows 20 ft. high with stout branches, oblong, two-ranked leaves and numerous minute reddish flowers in large panicled clusters borne below the leaves. The gooseberry tree has run wild in the West Indies and in Florida.

GOOSE CREEK, a city and port in Chambers Co. in southeastern Texas; situated about 28 mi. southeast of Houston, on Galveston Bay, Houston Ship Channel and the San Jacinto River. Buses, an interurban railway, steamers and two railroads serve the city. Cotton is the principal crop. The district produces oil, and petroleum products are the chief local manufacture. Owing to its strategic location on good waterways it is a shipping center for cotton and oil. The city was founded and incorporated in 1918. General SAM HOUSTON at one time lived in Goose Creek. The BATTLE OF SAN JACINTO, in the War of Texas Independence, was fought in 1836 6 mi. from Goose Creek. Pop. 1920, 1,000; 1930, 5,208.

GOOSEFISH, a name often applied to the ANGLER, a large marine fish of grotesque appearance found on both coasts of the North Atlantic.

GOOSEFOOT, in botany, the common name given to numerous herbaceous plants of the genus *Chenopodium,* several of which are known also as PIGWEED and LAMBS QUARTERS. *See* CHENOPODIUM.

GOPHER SNAKE, a common name for a variety (*Compsosoma* or *Spilotes corais couperi*) of harmless snake found throughout the southern part of the United States. It is large, frequently 8 ft. long, and black, with red markings around the mouth and toward the lower surface of the head. In some localities it is blue-black and highly polished; it is

then known as the indigo snake. It is also called black snake.

This serpent burrows in the ground, and is often found near houses or barns where rats, its favorite food, are plentiful; it also eats mice, gophers, squirrels, birds, other snakes, eggs, fish and lizards. It is believed by the southern Negroes to be a special enemy of the rattlesnake. Gopher snakes are easily tamed, and make good pets.

GORAKHPUR, the name of a city, district and division in the United Provinces, British India. The city is situated on the Rapti River and the Bengal and North Western Railway. The district of Gorakhpur is a broad plain, watered by the rivers Rapti, Gogra and Gandak. Buddha was supposedly born and buried in the district. The chief product is rice. Area 4,528 sq. mi. The division of Gorakhpur includes the districts of Gorakhpur, Azamgarh and Basti. Area 9,543 sq. mi. Pop. 1921, city, 57,985; district, 3,266,830; division, 6,720,715.

GORDIAN KNOT. *See* GORDIUS.

GORDIUS, the peasant king of Phrygia, whose wagon-pole was tied to the yoke with the "Gordian knot." The story ran that the Phrygians could not decide who should be their king, and consulting an oracle were told to select the first man who should come to them in a wagon. This man was Gordius, who became king and was the father of Midas. Alexander the Great passing the city of Gordium on his conquests, was told that an oracle had declared that whosoever should loosen the intricate knot on the oxen yoke of his wagon would rule over all Asia. Alexander cut the Gordian knot with his sword, so fulfilling the prophecy and becoming ruler of all Asia.

GORDON, CHARLES GEORGE ("Chinese Gordon") (1833-85), English soldier and explorer, born at Woolwich, Jan. 28, 1833. Receiving training at the military academy at Woolwich, he served in the Crimean War (1854-56) as lieutenant of Royal Engineers. In 1860-62, as captain and major, he was sent on explorations into China. When, in 1863, he went into the service of China, he was so successful in putting down the Taiping rebels, that the Emperor of China bestowed upon him high honors and decorations, from which he became known as "Chinese Gordon." In 1874 he was sent by Ishmail Pasha, the Khedive of Egypt, to explore the Upper Nile, being made a pasha and appointed by him governor-general of the Sudan. During this time Gordon opened up the country and suppressed the slave trade on the Red Sea. The abdication of Ishmail Pasha in 1879 terminated his connections with Egypt and he served the following years in various capacities in India, China, the island of Mauritius and the Congo. In 1883, when the forces of Hicks Pasha, sent by the new Khedive to put down the uprising of the Sudanese tribes under El Mahdi, were routed, Gordon was sent to collect the scattered troops and direct the evacuation of Sudan. He arrived at Khartum amid an enthusiastic welcome by the tribes and was at first successful in his mission. But the influence of Mahdi prevailed, and Gordon was besieged at Khartum with a small force. He held out for months with amazing energy and courage; but before reinforcements arrived, Khartum was taken and Gordon treacherously killed, Jan. 26, 1885.

GORDON, CHARLES WILLIAM. *See* CONNOR, RALPH.

GOREMYKIN, IVAN LONGINOVICH (1839-1917), Russian statesman, was born in the Government of Novgorod in 1839. He began his career as provincial vice-governor in Poland, and in 1891 was appointed assistant to the Minister of Justice. He served as Minister of the Interior 1895-1899, then entering the Council of State. In 1906, just before the opening of the First Duma, he replaced S. Y. Witte as President of the Council of Ministers and made an historic appearance when his duty compelled him to answer the Duma's daring address to the Throne and brought him a vote of censure. Upon the dissolution of the First Duma, he was relieved as President of the Council and replaced by Stolypin on the ground that he had not been sufficiently resolute in his resistance to the Duma's pretensions. On Jan. 30, 1914, he was again called to the Premiership, which he held until Jan. 20, 1916, being commonly recognized as a weak tool of the Rasputin clique. He was arrested and investigated by the Provisional Government, but later released. He was killed Dec. 17, 1917, in an attack upon his summer home in the Caucasus. S. H. C.

GORGAS, WILLIAM CRAWFORD (1854-1920), American army surgeon, was born in Mobile, Alabama, October 3, 1854. He received his preliminary education at the University of the South, Sewanee, Tennessee, and his medical education at Bellevue Hospital Medical College, New York, receiving his M.D. degree in 1879. He was instrumental in the elimination of yellow fever from Havana, 1898-1902, and, in connection with the work on the Panama Canal, he brought about not only elimination of the dreaded yellow fever but also other dangerous infections, making this section of the country a healthful community. He was president of the American Medical Association from 1908 to 1909. In 1914 he was made Surgeon-General of the United States Army with the rank of brigadier-general and became major-general in 1916, serving through the World War, and retired in 1918. He then became the permanent director of the yellow fever work of the International Health Board of the Rockefeller Foundation, and in that capacity made a survey of the endemic foci of yellow fever in South America. He received several honorary degrees from various universities and many other honors. He died in London, July 3, 1920, and was buried in Arlington National Cemetery, Washington, D.C. M. F.

GORGE, a deep and narrow chasm, with steep walls, resulting from the cutting of a stream downward through hard rock. Such gorges, more commonly termed CANYONS in the western United States, contrast with stream channels cut in soft shales, where

weathering widens the gap faster than the stream can deepen it.

Ausable Chasm, in the Adirondacks, is a typical gorge cut in hard sandstone, 100 to 200 ft. deep and nowhere more than 20 to 40 ft. wide. Swiss gorges are sometimes so narrow that overhanging rocks practically shut out the sky. A gorge excavated by pothole work is seen in Watkins Glen, N.Y.

GORGES, SIR FERDINANDO (c. 1566-1647), English pioneer in America, was born in Somersetshire about 1566. He served in the English army and navy and early in the 17th century joined the Plymouth Company to establish colonies in America, the charter of which was granted by the Council for New England. The Popham colony, founded in Maine, in 1607 by Gorges and other colonists was a failure, but after 1622 permanent settlements were established. In 1639 Gorges became lord proprietor of Maine under a royal charter making the grant hereditary, his son acting as provincial governor. In 1643 the four New England colonies allied themselves for common defense, excluding the Gorges settlements, which were annexed by Massachusetts after the death of Gorges at Long Ashton in 1647.

GORGIAS (c. 483-375 B.C.), Greek Sophist philosopher, was born at Leontini, Sicily, about 483 B.C. In 427 B.C. he was sent to Athens as ambassador from Sicily, becoming known there for his rhetorical powers and teaching this art to the Athenians. Gorgias's teachings led to the establishment of the Sophist school, which may be said to have stressed form, in philosophic thought and discussion, rather than substance. Ascribed to Gorgias are two celebrated orations, the *Encomium on Helen* and the *Palamedes*. In Plato's *Gorgias* occurs a dialogue between this master of rhetoric and Socrates. He died at Larissa, Thessaly, in 375 B.C.

GORGONS or **GORGONES,** in classical mythology, three terrible monsters, Stheno, Euryale and MEDUSA, who had snakes for hair and brazen claws. The most famous was Medusa, who had been a mortal loved by POSEIDON. ATHENA in jealousy changed her into a Gorgon with the curse that whoever looked upon her should be turned to stone. PERSEUS was able to slay Medusa by using a mirror, so that he would not look at her face. He then took the head before Polydectus and turned him to stone. Athena wore the head on her breastplate or aegis. In later art Medusa's face is represented as very beautiful.

GORHAM, a town in Cumberland Co., southwestern Maine. It is situated on the Presumscot River, 10 mi. west of Portland and is served by the Boston and Maine and the Maine Central railroads. Gorham is surrounded by stock-raising and dairying country. The chief local industry is tanning. It is a summer resort near the Atlantic Ocean, and is the seat of Western State Normal School and high and junior high schools. The town was incorporated in 1764. Pop. 1920, 2,870; 1930, 3,035.

GORILLA, an anthropoid ape (*Gorilla gorilla*) which inhabits the forests of equatorial Africa from Lake Albert Edward and the Kivu Mountains to near the Atlantic coast. The gorilla is the largest of all apes and so massive in frame that any example will weigh twice as much as a man of the same height, say 6 ft. The whole aspect is one of massive



GORILLAS

strength and brutality, intensified by the beast's terrifying roars. The forest Negroes justly fear it, and early writers charged it with malicious ferocity. Better acquaintance has modified this view. When aroused it becomes a very dangerous beast, but naturally it is shy, timid yet inquisitive, and quick to escape and hide when alarmed, showing no disposition to attack human intruders who do not threaten its own peace. The late Carl Akeley, who spoke from wide knowledge of the nature of this beast, wrote that "he is in every sense a splendid animal, in no sense aggressive or inclined to look for trouble."

As to the habits of these apes little is known. Their lives are spent in the deep forest, apparently in family groups that do not wander much. Food is always at hand, for it consists only of vegetable matter, leaves, young shoots and twigs, especially of palms, tender barks, and all sorts of fruit and succulent plants. The last named delicacies occasionally lead gorillas to raid and destroy native plantations at daybreak, but less often than do chimpanzees and baboons; at any rate gorillas descend to the ground frequently, seeking food and walking upright with ease. Probably it is in such excursions that babies are sometimes abandoned in fright, and captured. Several infant gorillas have been brought to Europe or America, but they survive only a short time. At nightfall the band

retires to its jungle fastness, where the females and young construct or repair platforms, or "nests," among the branches of big trees for the night's rest; but the older males are said to sleep more often on the ground near by, having nothing to fear but the possible pounce of a leopard.

The gorilla population of the Congo Basin is scattered and not very numerous. Sportsmen and other influences have reduced it considerably; and had not Mr. Akeley, supported by the Belgian king, obtained a restriction of shooting them, and had set apart by the government a great tract in the Kivu Mountains as an animal preserve, with special reference to the gorilla, this animal would soon have become extinct.

E. I.

GORIZIA, a town of northeastern Italy, capital of the province of the same name, situated about 20 mi. north of the Gulf of Trieste. Gorizia is famous for its Church of St. Ignatius built by the Jesuits in the 17th century. During the World War it was the scene of important battles on the Italian front. This necessitated the subsequent reconstruction of the town. Pop. 1931, 49,239.

GORKY, MAXIM (1868-), pen name of Alekoyey Maximovich Pyeshkov, Russian author, who was born at Nijni-Novgorod, Mar. 14, 1868. He grew up in extreme poverty, having to shift for himself from his tenth year. During the next 15 years he worked at innumerable jobs, roaming over the east and south of Russia, but in the meantime reading voraciously and trying to educate himself. At 25 he began writing, his first work, *Chelkash,* bringing him recognition as a writer of great power and original outlook. The stories and plays that followed in rapid succession were translated into other languages and soon gave Gorky international renown. He is at his best when dealing with the appalling conditions under which the very poor spend their lives. His autobiographical trilogy, *Childhood, In the World* and *Reminiscences of My Youth,* and his *Recollections* and *Fragments from My Diary* are well-known works. Two volumes of a second great trilogy were published in translation as *Bystander,* 1930, and *The Magnet,* 1931, dealing with Pre-Revolutionary Russia and the formation of Soviet Russia.

GORLITZ, second largest city in Prussian Silesia, situated about 53 mi. east of Dresden on the Neisse River. High Gothic towers and city gates and the Renaissance rathaus still indicate the wealth of the city. The Peter and Paul's Church there is one of the most important late-Gothic churches in Germany. Chief products are machines, railroad cars, glass, china and textiles. There is soft coal nearby. The chief trade is in grain and other food products. Mentioned in 1071 as a Slavic village, Gorlitz was capital of the duchy of Gorlitz in the last quarter of the 14th century. Pop. 1925, 91,702.

GORSE, one of the common names given to the FURZE (*Ulex europaeus*), a spiny shrub common in many parts of Europe. It is widely cultivated as an ornamental.

GOSHAWK, a genus (*Astur*) of rather large, short-winged hawks noted for their powerful flight, courage and activity. There are more than 60 species, nearly cosmopolitan in distribution, three forms occurring in North America. The American goshawk (*A. atricapillus*), breeding from the northern states northward and wintering as far southward as Virginia, is about 2 ft. long, and when adult is slaty



G. M. SUTTON, "BIRDS OF PENNSYLVANIA"
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AMERICAN GOSHAWK

blue above and gray and white below. It is one of the most daring and rapacious of all hawks and preys largely on small mammals and birds, doing great injury to game birds and poultry. Its bulky nest, in which are laid 2 to 5 whitish eggs, is placed in trees in the thickest forest. The western goshawk (*A. a. striatulus*), occurring from Sitka, Alaska, to California and eastward to Idaho, is similar but darker.

GOSHEN, a city in northern Indiana, the county seat of Elkhart Co., situated on the Elkhart River, 10 mi. southeast of Elkhart. Two railroads, airplanes and bus and trolley lines afford transportation. The chief crops of the vicinity are grain and fruit. Paper, iron, woolen and wood products are the principal manufactures. The retail trade in 1929 amounted to $6,026,324. Goshen College, founded by the Mennonites, is located here. The city lies within a beautiful region having 100 lakes and many popular resorts. Goshen was founded in 1828 and chartered in 1868. Pop. 1920, 9,525; 1930, 10,397.

GOSNOLD, BARTHOLOMEW (d. 1607), English navigator and one of the founders of James-

town, Va. In 1602, Gosnold commanded the *Concord,* an expedition ship which Sir Walter Raleigh and associates chartered. This expedition sailed along the Atlantic seaboard of North America from Maine to Martha's Vineyard and discovered and named Cape Cod. Gosnold sailed with Christopher Newport in 1606-7 on the expedition which brought the first colonists to Jamestown, Va., and also discovered and named Cape Charles and Cape Henry. He assisted Captain John Smith in the government of Jamestown and died there from swamp fever, Aug. 22, 1607.

GOSPEL, an English word translating the Greek *Evangelios,* and probably composed of the words god, meaning good, and spell, meaning news, and is commonly rendered as "glad tidings." Specifically it refers to glad tidings concerning God associated with Jesus Christ and his religion and has come to denominate the four canonical books which open the New Testament, each being "the good news" according to one of the early followers of Christ. The word is sometimes used nowadays to emphasize the evangelical character of a sermon, and in the liturgies of the Anglican and Catholic churches, the gospel for the day is read and sung at the service.

GOSPORT, a seaport and municipal borough of Hampshire, England, situated 81 mi. southwest of London. It is on a peninsula lying to the west of the harbor of Portsmouth with which city it is connected by a floating bridge. Held in the 11th century by the bishop and monks of Winchester, by the 16th century when it first acquired harbor defense fortifications, it was an insignificant fishing village. As a victualling station in that and the following centuries it became increasingly prosperous, particularly during the American and Peninsular wars. Gosport to-day is important as a naval depot. Pop. 1921, 35,560; 1931, 37,928.

GOSSAMER (*Erigone*), a minute spider of the family *Linyphiadæ.* It lives near the ground, appearing in great numbers after the first frosts. It climbs as high up as possible, and turns its spinnerets upwards, letting the threads of silk be drawn out by air currents. The spiders are often lifted off their feet and carried long distances, and in the right season the air and whole countryside are filled with floating silken threads called "gossamer."

GOSSAN, called also "Iron Hat" and "Iron Cap," refers to the appearance often shown by Outcrops of quartz veins containing iron sulphides, such as Pyrite. Weathering dissolves the sulphides, leaving a cellular mass of quartz stained yellow or brown by limonite, an oxide of iron resulting from the alteration of iron sulphides. Since ore minerals often occur in such veins, a gossan is occasionally the indicator of an underlying Ore Deposit.

GOSSE, SIR EDMUND WILLIAM (1849-1928), English critic and poet, was born in London, Sept. 21, 1849. He did not attend a university, but his literary work won him several honorary degrees, many European orders, a knighthood in 1925 and the friendship of Stevenson, Swinburne and other literary celebrities. In 1867 he was appointed assistant librarian to the British Museum. In 1884 he lectured at Harvard, Yale, Johns Hopkins and other colleges. From 1904 to 1914 he was librarian to the House of Lords. Gosse's works include *Madrigals, Songs and Sonnets,* 1870, *On Viol and Flute,* 1873, *Northern Studies,* 1879, *Congreve,* 1888, *History of Eighteenth Century Literature,* 1889; *The Secret of Narcisse,* 1892, *In Russett and Silver,* 1894, *The Jacobean Poets,* 1894, *Critical Kit-Kats,* 1896, *A History of Modern English Literature,* 1897, *Life and Letters of John Donne,* 1899, and other works, including biographies of Jeremy Taylor, Coventry Patmore, Sir Thomas Browne, Swinburne and Henrik Ibsen. His *Father and Son* was crowned in 1913 by the French Academy. As a critic Gosse possessed great learning, quick sympathies and a graceful prose style. He died May 16, 1928, in London.

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GOSSEN'S LAW, in economics, a mathematical formulation of the law of final utility in its philosophical implications as formulated by Herman Heinrich Gossen, 1810-58, a German economist who was one of the first to attempt mathematical formulations of economic doctrines. Gossen attempts to demonstrate that the law of diminishing utility runs parallel to the utilitarian laws of pleasure and that consequently a plan for labor both individual and social may be constructed on mathematical principles, so that the maximum of pleasure and utility may be derived from labor. Lastly Gossen attempts to establish a theory of final utility on the principle of economic equilibrium.

GOSSON, STEPHEN (1555-1624), English actor, cleric and miscellaneous writer was born in 1555, and received his B. A. degree from Oxford University in 1576. Meres's *Palladis Tamia,* 1598, notes his "admirable pastoralls." Lodge states Gosson had been an actor, and it is known that he wrote several plays, one of which was *Catiline's Conspiracies.* His attack on the stage, *The Schoole of Abuse,* 1579, brought forth Sidney's *Apologie* and Lodge's *Defence,* to which Gosson replied in *A Short Apologie,* 1579, and *Plays Confuted,* 1582. After taking orders he became rector of Great Wigborough, Essex, and of St. Botolph's, Bishopsgate. He died Feb. 13, 1624.

GÖTEBORG or **GOTHENBURG,** the second city and chief seaport of Sweden, situated on the west coast. It is the leading shipbuilding center. The city is connected with Stockholm and the interior by the Göta Canal and by electric railway, and is on the railway express route between Copenhagen and Oslo. Göteborg was founded by Gustavus Adolphus in 1619, and has been an important shipping center since the 18th century. It handles much of Sweden's staple export of timber; exports iron, wood pulp and paper in large quantities, and has sawmills, machine shops and other industries. It is the home port of the Swedish-American Steamship Line, es-

tablished 1915. Göteborg is a well-built city, with two charming parks, a university, a marine museum, a school of navigation and an art museum. In this city originated the plan of liquor regulation which, adopted here in 1865, was in 1914 adopted throughout the country. Pop. 1931, 245,711.

GOTHA, a German city in the state of Thuringia, situated about 13 mi. west of Erfurt. Until 1918 it was capital of the duchy Saxe-Coburg-Gotha. The old city lies on the slope of a hill surmounted by a castle and is surrounded with garden suburbs. The late-Gothic Church of St. Margaret is noteworthy, as is also the Church of the Augustinians of 1258, the palace and the rathaus. Gotha's important industries include map making, book publishing, railway carriage building and machine and rubber manufacture. Its trade is chiefly transit in character. It is the home of important insurance companies and of a geographical institute. Gotha was first mentioned in 775. Pop. 1925, 45,780.

GOTHAM, a village in Nottinghamshire, England, the proverbial center of fools and folly. The original "Wise Men of Gotham" were inhabitants of this village who pretended to be idiots to prevent King John from building a castle near Gotham. The 16th century *Merrie Tales of the Mad Men of Gotham* is attributed to Andrew Boorde (d. 1549). Gotham is also a sarcastic name for New York City. It was first used by Washington Irving in this application in his *Salmagundi,* 1807.

GOTHIC, the oldest GERMANIC language known, and thus of paramount importance for historical study of the whole group of Germanic speech-forms. It is the sole East Germanic dialect of which there are any monuments of note, these consisting in the main of fragments of a translation of the Bible by the Visigothic Bishop Wulfila, or Ulfilas (311-382), who invented his own alphabet, adapting chiefly the Greek letters of his time, with the addition of a few Latin and some runic characters (*see* RUNES). Evidence of the great antiquity of Gothic is its retention of a dual form of the verb and a medio-passive voice. Gothic did not survive the downfall of the Gothic kingdoms in Italy and Spain; but remnants of a dialect of it lingered on in the Crimea until the 18th century. E. Ro.

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GOTHIC ARCHITECTURE, the style whose forms were developed in the final complete solution of the problems of building a high, adequately lighted, stone vaulted church with nave, aisles, triforium and clearstory. Attempts have been made to limit the term to church architecture in which certain structural ideas are dominant, but the best general usage is to make the term cover all buildings in which the forms so developed are used. Gothic architecture in general is the architecture of the greater part of Europe, during the period from about 1150-1200 to the development of the Renaissance. (*See* RENAISSANCE ARCHITECTURE.) Its chief characteristics are: pointed arches, ribbed vaults, flying buttresses, large windows often subdivided by tracery, tracery itself, decorative forms resulting from structural needs, carving which is generally naturalistic, the frequent but not universal emphasis on vertical lines, and above all, a sense of structural logic as the basis of design, with decorative features resulting mainly from structural form.

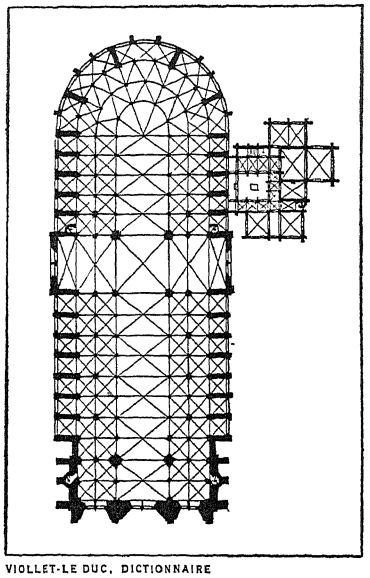
GOTHIC ARCHITECTURE IN FRANCE

The Abbey of St. Denis, near Paris, dedicated 1144, was the first church to merge the pointed arch with the ribbed vault; and so the first church that can be called Gothic. Its east end still reveals the mixture of round and pointed arches, ribbed vaults, and the elaborate plan with which the Abbot Suger tried to outdo all existing French churches. The present nave is a rebuilding on different lines dating from about 1240-80. Despite the Romanesque character of the ornament, and the continuing partial use of the round arch, Abbot Suger's church was so advanced structurally, in its use of ribbed vaulting and an elaborate buttressing system, the effect so beautiful, and the practical advantages so great, that it is not strange to find these ideas adopted wholesale all over North France in a short time. The new demand for great cathedral buildings to express alike the new dignity of the secular clergy, and the growing importance of town life itself, offered a tremendous number of opportunities for the new style. Thus Sens Cathedral dates from 1140-68, the present vaults being later; Noyon was begun in 1150, Laon by 1161, Paris in 1163, Soissons, south transept, in 1175, and Chartres in 1194. All are in the Gothic style, applied with continually increasing sureness. Yet all these churches are in a Gothic style still tentative and experimental, with the possible exception of Chartres. Both round and pointed arches are used in some of them. Even the main horizontal divisions of the height of the nave are uncertain.

The desire to have a complete vaulted triforium gallery led to a fourfold division in Noyon, Laon, Soissons and Paris: the pier arch leading to the side aisle, the arcaded opening of the upper gallery, the clearstory, and between the last two a space corresponding to the side aisle roofs, which was decorated with a little arcade, or, in Paris, a decorated circular opening. The clearstory windows still remained small, with sills on the level of the vault spring. Yet the progress made in the period was amazing. In Chartres, not only was the upper side aisle gallery omitted, giving at once the usual triple division of pier arch, triforium and clearstory, but also the clearstory windows themselves were much larger. Their sills were far below the vault spring, and the windows showed developed plate tracery; that is, the whole area was divided into two lights, or smaller windows, above which, pierced in the thin stone beneath the enclos-

ing wall arch, was a pattern formed of circular cusped holes.

In the early years of the 13th century plate tracery was already yielding to bar tracery, in which the upper part of the window was formed not of circles pierced



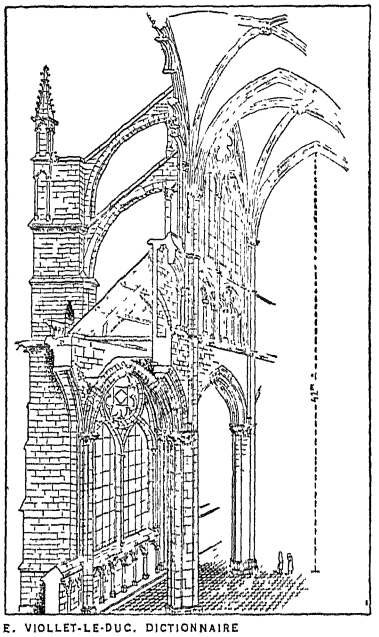
VIOLLET-LE DUC, DICTIONNAIRE

PLAN OF CATHEDRAL OF NÔTRE DAME, PARIS

in a wall, but of circles surrounded by thin bars of stone. In Notre Dame in Paris, for instance, when the aisle roofs were destroyed in a fire some time between 1210 and 1230, the roofs were lowered, and simple bar tracery windows of large size were used to replace the early high, small windows and the cusped circle below, thus producing the sought for triple division.

The vaulting of this early period was also somewhat tentative in character. The combination in late Norman Renaissance work (*see* ROMANESQUE ARCHITECTURE) of the Lombard square, ribbed vaulted nave bay, occupying the space of two side aisle vault bays, with the French love of unity and continuity in design, had produced in the 12th century vaults of the Abbaye Aux Hommes at Caen the SIX PART VAULT. This was the type adopted originally in Noyon, and still preserved in Laon, Paris and Bourges. This solved the problem of the continuity of the interior walls of the nave, but the radiating ridges of the cross vaults still disturbed the regularity of the composition. As soon as the French builders realized the flexibility of the pointed arch, therefore, the six part vault was abandoned, and the more usual standardized four part vault, with rectangular nave bays, was adopted. Its first complete expression on a large scale, was in the Cathedral of Chartres; from that time on its use became more and more common.

Structural System. The rapid domination of Gothic architecture by the pointed arch was largely a matter of its structural flexibility. One difficulty with Romanesque round arched ribbed vaults was the dependence of the heights of round arches upon their width. If the diagonal groin ribs are circular, they rise much higher than the cross ribs, because their span is greater, and each bay becomes unpleasantly domed up in the center. In a vaulting bay of rectangular plan, this problem becomes still more complicated. But the heights of pointed arches are entirely flexible and can be adjusted to fit any conditions. In many French Gothic churches the diagonal ribs are semicircular, and the cross ribs are pointed as necessary to reach an approximately equal height. The much narrower wall rib arches are not only pointed, but spring from a higher impost line, a scheme that allowed large clearstory windows.



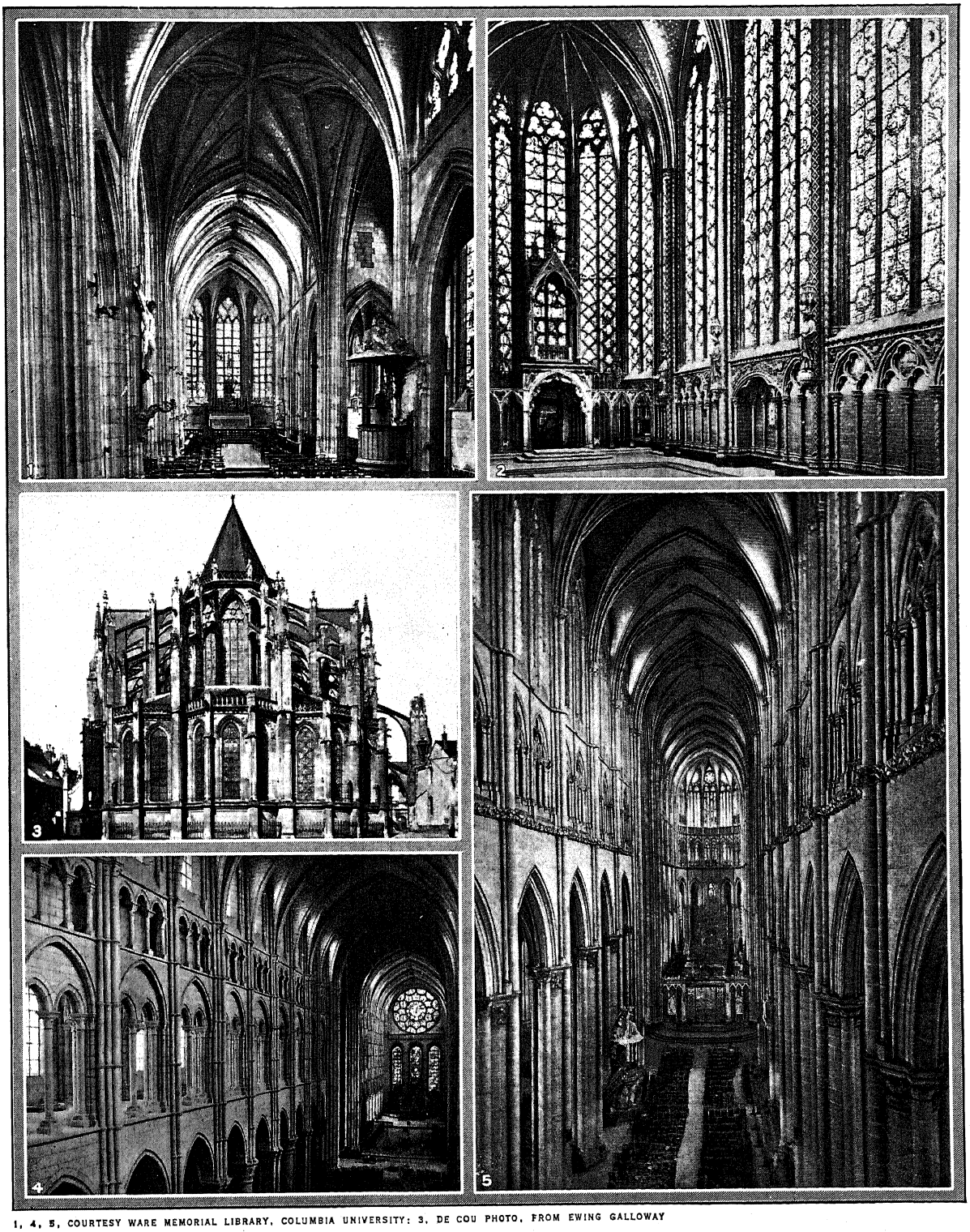
E. VIOLLET-LE-DUC, DICTIONNAIRE

SECTION OF THE NAVE, CATHEDRAL OF AMIENS, FRANCE

Another great Romanesque difficulty lay in the vaulting of the ambulatory around a semicircular or polygonal apse. With round arches, the radiating bays created almost insuperable problems. The groins took on unpleasant wavy curves, the intersection of cones with an annular surface; or, if straight groin ribs were used, they intersected at a point far from the high portion of the vault. The use of pointed arches eliminated this trouble, for each half of a pointed arch was independent, and the groin ribs did not need to be continuous in plane. The summit of the vault bay could be placed where it was most aesthetically desirable, and the groin ribs made to meet at that point. This simple solution was the result of many experiments. At times the number of supports in the outer line of piers or walls was increased, giving triangular vaulting bays as in Paris, with a variation in Soissons.

The thrusts of high nave groined vaults, concen-

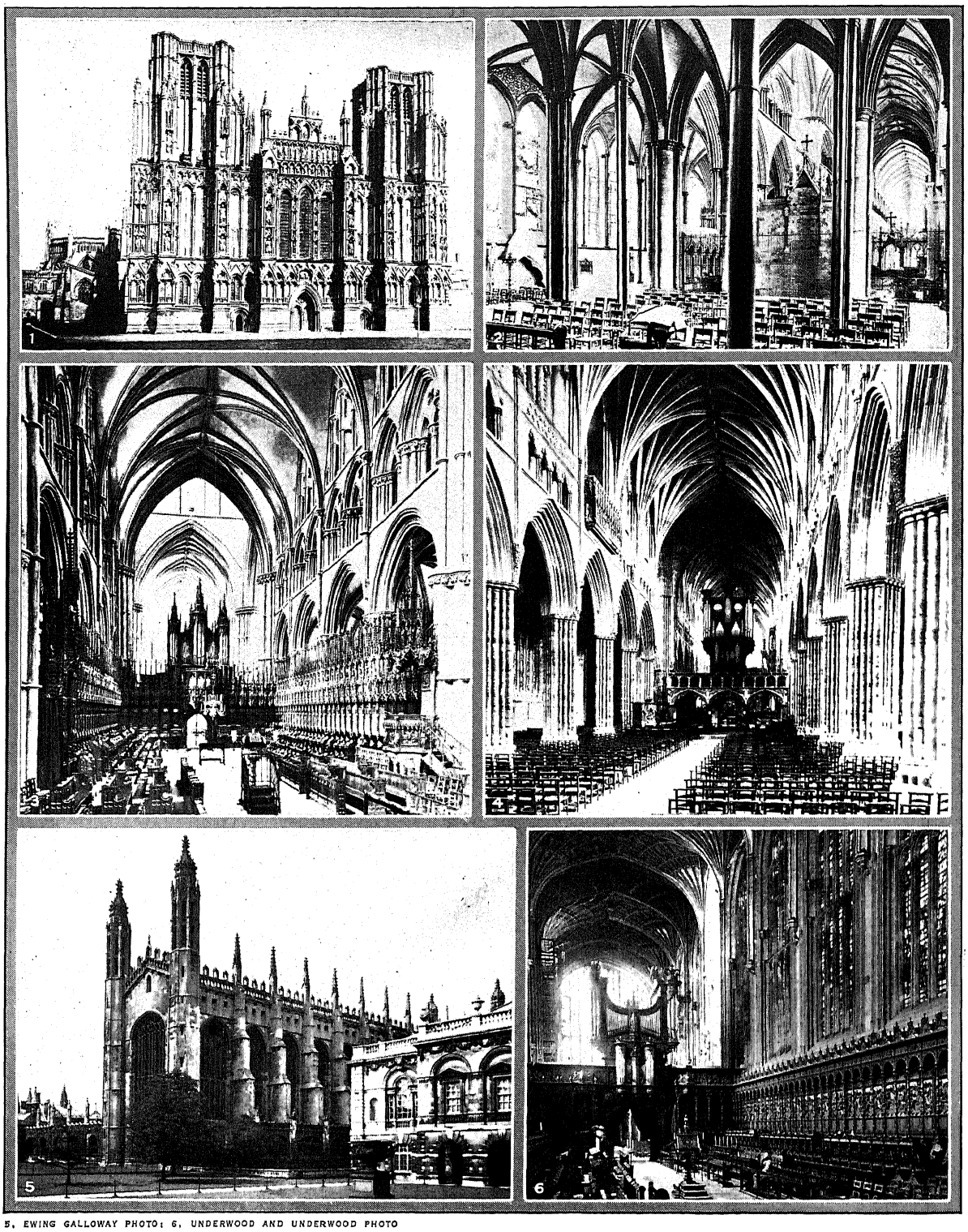
GOTHIC ARCHITECTURE



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GOTHIC CHURCHES OF FRANCE

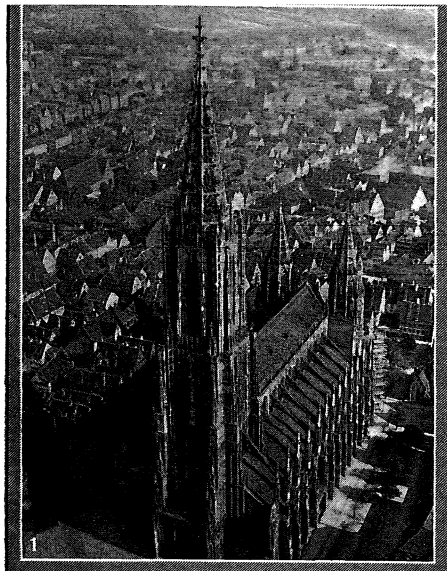
1. Flamboyant nave of the Church of St. Germain, Amiens, France. 15th century. **2.** Upper chapel of Sainte-Chapelle, Paris. 1245-48. **3.** Apse of the Cathedral of St. Gatien, Tours. 13th century. **4.** Interior of the Cathedral of Notre Dame, Laôn. 12th century. **5.** Interior of the Cathedral of Notre Dame, Amiens. 13th century.



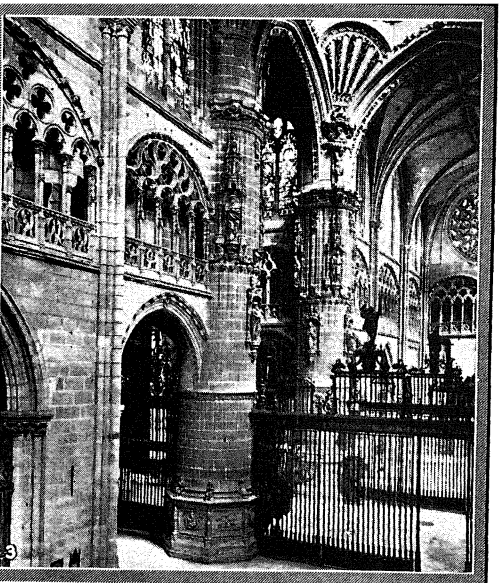
5, EWING GALLOWAY PHOTO; 6, UNDERWOOD AND UNDERWOOD PHOTO

GOTHIC CHURCHES OF ENGLAND

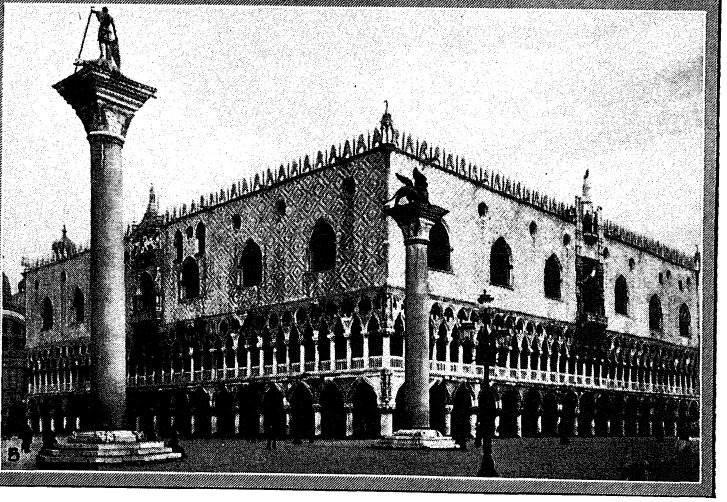
1. West façade of Wells Cathedral. 13th century. **2.** West end of Lady Chapel, Salisbury Cathedral, 1220-60. **3.** Nave of Lincoln Cathedral. 13th century. **4.** Nave of Exeter Cathedral, looking east. 14th century. **5.** Chapel of King's College, Cambridge, one of the finest examples of Perpendicular Gothic architecture in England, built in 1446-1515. **6.** Interior of King's College Chapel, showing the fan-vaulted ceiling and early Renaissance carved stalls.











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GOTHIC ARCHITECTURE IN ITALY, GERMANY AND SPAIN

1. Münster of Ulm, Germany. 14th-16th centuries. **2.** Nave of the Cathedral of Erfurt, Germany. 13th century. **3.** Late Gothic choir of the Cathedral of Burgos, Spain. **4.** Interior of the nave of the Church of Santa Croce, Florence, Italy. 13th-15th centuries. **5.** Palace of the Doges on the Piazetta di San Marco, Venice. 14th-15th centuries.

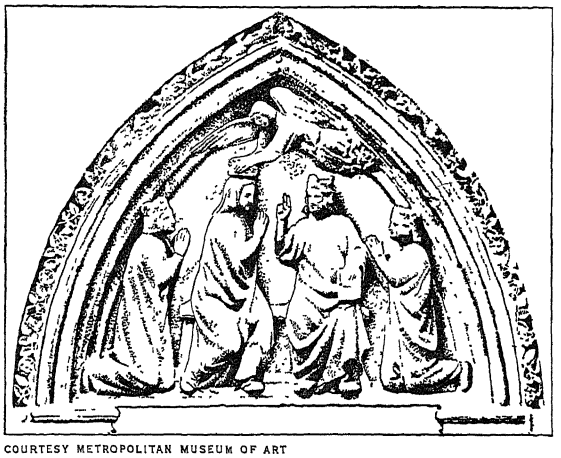
trated at the piers, are enormous. Buttresses to withstand them were too heavy to be carried on the side aisle cross ribs; some other method was necessary. The flying buttress was the answer. Buttresses of large size could be built on the outside of the church walls. Arched struts of masonry, or the flying buttresses proper, could be as easily built above the side aisle roofs to convey the nave thrust down and out to the external pile of masonry. The exact direction and point of application of a vault thrust is a mathematical abstraction; sometimes in Gothic work the nave end of the arched strut is above, sometimes below it. Common sense rather than mathematical theory governed, and aesthetic considerations were important.

It is obvious that the heavier the weight of the wall above the vault, the less the thrust will be. This led to the universal French Gothic custom of continuing the nave walls above the clearstory windows up to a level higher than the crown of the vaults. On this wall was built the wood constructed, metal covered roof, as well as a heavy stone gutter and parapet. Moreover, the heavier the buttresses, the less they need to project. The designers found that within certain limits an equal amount of stone could be more efficiently used in weighting them at the top than in extending their width. Hence arose the custom of building pinnacles on the tops of the buttresses. Early examples are simple, solid and gabled, as in Notre Dame at Dijon, about 1225. But as skill increased and the decorative possibilities were realized, they became higher and lighter, crowned with crocketed spires instead of gables, until there were such rich and airy examples as those of Rheims or Amiens.

The ribbed vaulting system and the perfection of buttress design all tend towards diminishing the importance of the wall. The final completed Gothic church is therefore a purely skeleton building; its structural articulation one of isolated piers, vaulting ribs, window arches, flying buttresses and buttresses. Walls become mere fillers between piers where windows or doors are not desired.

However structurally founded, Gothic architecture is only in rare examples mechanical or theoretical. Its peculiar warmth, splendor and vitality arose from the fact that the Gothic architect, though seldom contradicting structural elements, made each an integral part of a decorative scheme. Tracery, begun as a simple framework to subdivide a large opening, became a decorative element of almost endless flexibility. Vaulting shafts, frequently of no actual structural use, were carried down the faces of the nave wall to give the aesthetic satisfaction of repeated vertical lines. Capitols were carved below the springing of the arches. Ribs and arches were strongly molded to accent their curves.

Similarly, on the flanks and east ends of the churches, buttresses, flying arches and pinnacles were richly decked with carved cornices, crocketed gables and spires and figure sculpture. Even rain water spouts, gargoyles, offered an opportunity for endless grotesque invention. All became a symphony to lead the eye irresistibly upward. Yet the west fronts of the French cathedrals show how independent the Gothic architects were, how free from the dictation of any a priori expressionism. The essentials of these west fronts were twin towers, three doors, to the nave and side aisles, and a round nave window. The towers masked the ends of the aisles, and their corner buttresses formed recesses in which the doors were placed. Strong horizontal bands of sculpture and arcading bound the whole together; the great west front of Paris shows with what magnificent effect. In Rheims and Amiens the additional projection of the tower buttresses allowed the portals to become porches, and permitted a great richness of sculptural decoration. Perhaps never in the history of architecture have sculpture and architecture become so perfectly wedded.



COURTESY METROPOLITAN MUSEUM OF ART

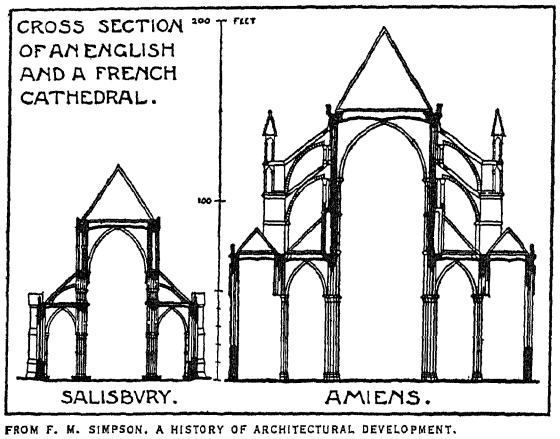
TYMPANUM OF THE CHOIR DOORWAY, NOTRE DAME, PARIS
Showing the coronation of the Virgin

Ornament. The Gothic period was born at a time when Romanesque ornament was at its highest development. No more could be done with it; fresh forms were necessary. They were found in a new turning to nature, and in the form known as the crocket, a tight ball or wad of foliage projecting in a sweeping curve from a molding or capital. Crockets and the newer, naturalistic foliage at first appeared in thick, tightly rolled forms, like buds just opening, or scarcely unrolled fern fronds; later more uncurled mature forms were found. As the 13th century developed, the leafage used became more and more naturalistic, especially in England, until the use of actual individual, recognizable leaves, fruits and flowers was common.

With this development of naturalism in foliage, there was a similar development in figure sculpture. Classic influence still persisted, in some cases even seems increased, and the calm repose of heads and hands, as well as the lovely fall of drapery, that characterized the best architectural sculpture of the 13th century had much in common with the Greek work

of the 5th and 4th centuries B.C. At the same time there was a great limitation of grotesque work, and its character changed. It is found in gargoyles or water spouts, or for use on the roofs, and occasionally in the little panels on the lower portions of doorways. In it, the old savage, strident intensity of Romanesque grotesque carving has gone, yielding to a more suave humor.

The Rayonnant Style. The developed Gothic style of the last half of the 13th century and the early 14th century in France is known as rayonnant, from the radiating character of the rich tracery of the enormous rose windows that were typical of it, such as those of the transepts of Notre Dame in Paris, about 1280. The chief monuments of the style are the great cathedrals of Rheims, begun in 1212; Amiens, begun in 1220, and Beauvais, begun in 1225. In them there was no longer the slightest hesitancy; complete mastery of the structural requirements of the Gothic church had set the builders free to pursue their aims



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untrammeled. These aims were: height and the effect of height; great window areas to receive stained glass; bar tracery developed on a geometric basis, the forms used being pointed arches for the lights and cusped circles or curved sided triangles with cusping above, and in the rose windows chiefly radiating lobes ending in pointed arches grouped with circles and cusped forms; growing lightness and delicacy of structure; elimination of wall surfaces, and sometimes, where they occur, enrichment by means of wall tracery; exteriors with vertical lines emphasized in every way, and many towers. In Chartres eight were originally planned, in Rheims, seven. All were to have spires of either stone or lead covered wood. This multiplication of towers was evidently an attempt to mask the length of these buildings, and give a unity to their multiplicity of parts.

In the choir of Amiens, the desire for glass area led to the flattening of the roofs of the ambulatory, and the piercing and glazing of the triforium wall. In Beauvais, the search for lightness and height led to disaster; the choir, with a vault whose ridge is over 150 feet in the air, had hardly been completed before the over-light piers failed and the vault crashed. Rebuilt, it fell again; then the number of piers was doubled and the choir finally completed in its present form in the last years of the century. The effect of height produced by the narrow bays is overwhelming, but already the seeds of style decay are present, and the effort to astonish has superseded the search for a more pure, if less ostentatious, beauty.

In the Ste. Chapelle of the palace in Paris, designed by Pierre de Montereau for Louis IXth (1242-47), the rayonnant style may be seen at its height. The upper chapel seems to have a vault resting almost on the air, so slim are the apparent supports, so enormous the area of beautiful stained glass. The whole is a light and delicate cage, almost like the enclosure of outside air. On the outside also the rising lines of the buttresses that hold up the vault give the sense of dynamic height the rayonnant builders desired. In the church of St. Urbain at Troyes, built during the end of the 13th and the beginning of the 14th centuries, and in the 14th century St. Nazaire at Carcassonne, the choirs have no triforia at all, and the window tracery is developed to the highest possible point. Another characteristic element of the rayonnant style is the development of the decorative gable, with no roof behind, over an arched window, and later, the piercing of this gable with bar tracery. The possible lace-like lightness is well seen in the transept doors of Rouen Cathedral. But over-elaboration of tracery and over-lightness in construction led eventually to thin, wire-drawn effects, cold and mechanical, like that of the great abbey church of St. Ouen at Rouen. The style had lost its power in the search for mere cleverness.

The Flamboyant Style. This decline in creativeness accompanied a period of disease, poverty and foreign domination. It was only with the defeat and departure of the English from southwestern France in the 15th century that much building was again undertaken. In this work the older traditions largely gave way to new ideals, and the influence of the English curvilinear tracery was marked. The particular French style that thus developed, and lasted until well into the 16th century, is called flamboyant, from the flame-like forms of the tracery that distinguish it.

New expressions for structural Gothic requirements were invented which seem often strangely modern. Functionalism was allowed to control interior church design. Carved capitals were often omitted, and the vaulting rib and arch moldings continued unbroken to the floor, as in St. Maclou, at Rouen; or else allowed to die into plain unmolded piers. The triforium was often absent. Moldings themselves were small in scale, complex and varied in section, and at corners, and arch tops, allowed to intersect and pierce each other in the most interesting ways. Double and triple bases were common.

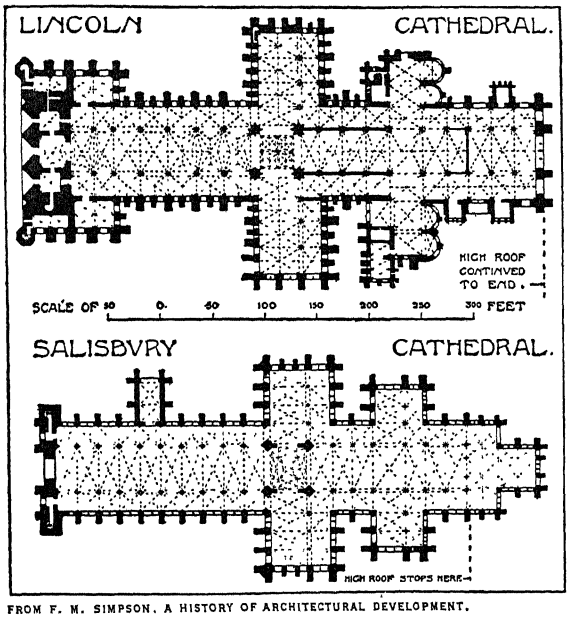
At the same time there was a continual search for ornamental richness, especially on the exteriors. Flamboyant tracery forms filled gables and parapets, and there was a luxurious development of miniature

buttress shapes, little crocketed gables and spires to form canopies over small statues, or to give texture to large surfaces. The decoration was often tiny in scale, and incredibly lavish and perfect in execution. Carved ornament was thin, nervous, full of contorted curves. Crockets seem often based on seaweed forms. In the latter part of the period, elliptical arches became common; there was sometimes a baroque extravagance in the treatment of hood molds, or projecting moldings around an arch, and gables, and the later tracery was often full of ugly circular depressed curves with a sort of confused stoginess. Figure sculpture grew more and more realistic, individualistic, dramatic; its unity with architecture was lost.

The style may be studied at its best in St. Maclou at Rouen, 1432-1500; St. Wulfram at Abbéville, 1480-1537; St. Jaques at Dieppe, St. Gervais, Paris, early 16th century; the south transept façade of Beauvais, 1500-48; the choir stalls of Amiens, 1508-19, and in such secular buildings as the Palais de Justice at Rouen, c. 1499-1510, and the Chateau of Jocelyn, Josselin, 16th century. Its contorted and restless worst can be seen in the famous church of Brou, Bourg en Bresse, 1511-36.

GOTHIC ARCHITECTURE IN ENGLAND

Although the first Gothic work in England was due to French influence, the differing English taste soon produced a great divergence. The choir of Canterbury Cathedral, begun in 1175, was designed by a



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PLANS OF LINCOLN AND SALISBURY CATHEDRALS, ENGLAND

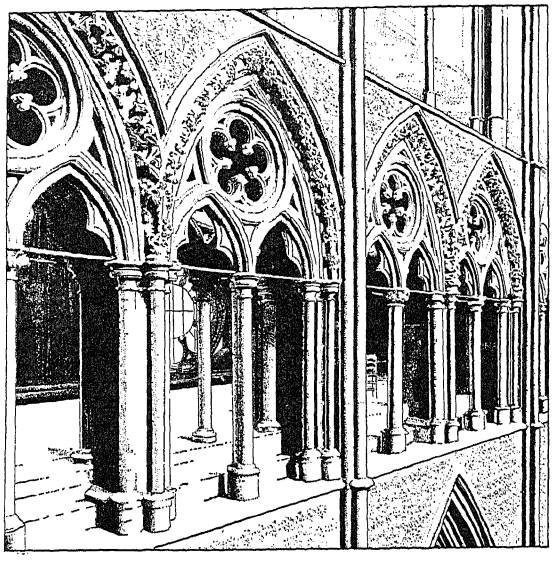
French architect, William of Sens, and shows marked resemblances to the Cathedral of Sens. William the Englishman, who succeeded as director of the works in 1179, apparently only carried out the design already set. The choir of Westminster Abbey, 1245-69, was also under French influence in its height and general structure. Elsewhere the English love of rich surfaces, great length and multiplicity of parts had created such cathedrals, usually also Abbey Churches, for in England there never occurred the intense rivalry between secular and monastic clergy as that in France—as Salisbury, begun 1220, the earlier parts of Lincoln, begun 1209, and parts of York south transept, c. 1240.

In the interior of these churches, horizontal lines were emphasized; vaulting shafts were treated erratically, frequently stopping at the level of the triforium gallery on richly carved corbels. Arch moldings and pier plans grew more and more fine scaled and complicated, often taking the form of a continuously waved surface full of small projecting rounds and deep hollows. Small shafts of black marble were frequently grouped around light colored stone piers. Windows were comparatively small and of the long, extremely pointed lancet type, frequently grouped, as in the "Five Sisters" in the transept of York. Most important of all experimental changes occurred in the vault system. These consisted in the building of ridge ribs and later, the building of additional ribs, called tiercerons, between the pier and the ridge ribs. The result was a branching, tree-like richness of effect, as in the choir of Ely Cathedral, 1235-51, a richness still further developed in the later Gothic English styles. The monastic character of the principal English churches was evident in the sharp division between the nave, for the people, and the choir, for the clergy, and the often added Lady Chapels and Retro choirs. The English preference for the square east end, instead of the apse, was due at least partly to Cistercian influence.

There was never in England the French love of the clear expression of structural members. Buttresses were not emphasized; there were few pinnacles; and flying buttresses were usually concealed. The result was informal, picturesque, rambling and rural. The most complete Early English church is Salisbury Cathedral.

English Decorated. By the middle of the 13th century the lavish development of tracery led to the first part of the so-called "Decorated" Gothic period, the Geometric. Wall arcading became much richer and more common; lancet windows yielded to large windows with tracery; the square east ends gave marvelous opportunities for rich tracery development. The great east window of Lincoln Cathedral, eight lights wide, divided first into two groups of four lights and then subdivided into four groups of two lights, is perhaps the most perfect example. It shows, too, the English tendency to have the spring line of the main arch and the arches of the small lights identical. The great polygonal chapter houses of Westminster and Salisbury show both the enormous windows, geometrically divided, and the richness of vaulting ribs, that are typical of the style. Little thought was sometimes shown in the application of this richness. The spacing of decorative arcades was most erratic; often

there was a too great softness of forms, and entire fronts, like that of Wells, were covered with arcading, confused in pattern, and often awkward. In the later examples of the early 14th century, cusped forms were much used in the tracery without enclosing arches or circles. The gain in freedom was paid for by the lack of definiteness. At the same time English leaf ornament was progressing towards a greater and greater naturalism, and carved capitals approached wreath-like contours. The most remarkable monu-



DETAIL OF TRIFORIUM, WESTMINSTER ABBEY, LONDON

ments of the style are Westminster Abbey, 1245-69; Lichfield Cathedral, about 1330, and the "Angel Choir" or Retro-choir of Lincoln Cathedral, 1255-80.

During the early 14th century, the English began to use lines of reverse curvature in tracery, so that forms could be made to flow. This discovery led to the development of the second type of English Gothic, the Curvilinear, that lasted almost through the century. Endless variety in these tracery patterns is found. In general they may be divided into two classes, those in which the flow of line is regular and repeated, giving rise to reticulated or net-work windows, and those in which the design is a free combination of twisting forms growing out of the arched heads of the window lights.

Naturalistic carving, arcading and vault ribbing also grew more complex. Not only were tiercerons multiplied, to give a lovely upshooting spray of ribs curving up from each pier, such as that of Exeter Cathedral, 1270-1335, but also, towards the end of the period, smaller connecting ribs, known as liernes, were introduced tying together ridge ribs and tiercerons into all sorts of patterns of the greatest richness, as in the Lady Chapel of Ely Cathedral, 1321-49. Moreover the reverse curves of the tracery windows were introduced into pinnacles and gables, and in miniature were used on interior wall arcades, tombs, statue canopies, and the like. The curvilinear period was also the period of the highest point of English naturalistic carving, as in the portals of Southwell Minster, about 1300, and the corbels in Exeter Cathedral. Other important monuments of the style are the



GOTHIC SEVERY CONSTRUCTION
Ceiling of the nave, Exeter Cathedral

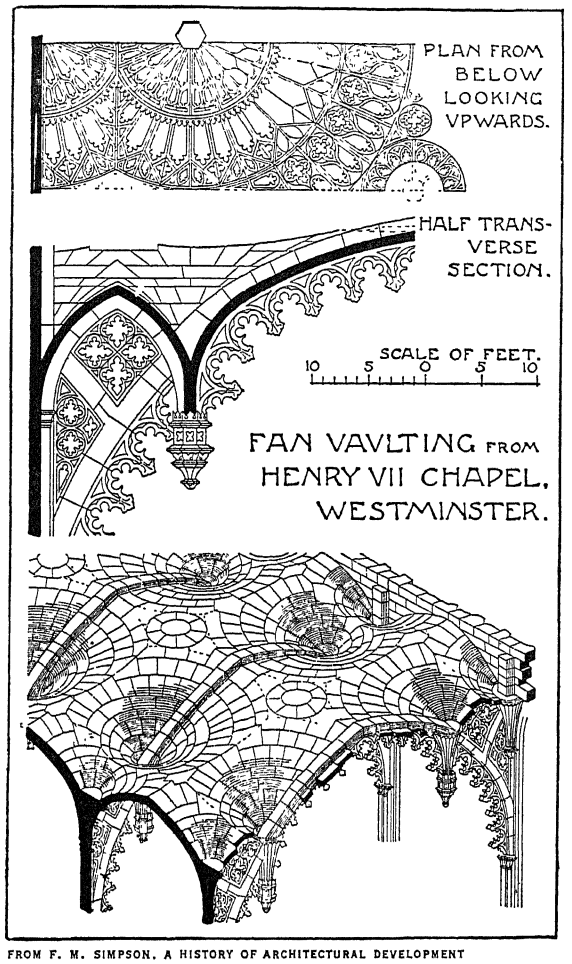
octagon over the crossing at Ely, 1327-42; Selby Abbey east end, 1330-40; the west end of York, about 1325, and the east window of Carlisle, about 1320-60.

English Perpendicular. The reaction against the sinuosities of the English curvilinear style gave rise to the Perpendicular style. It began to appear in the remodeling of the transepts and choir of Gloucester Cathedral, 1330-70. The great east window, about 1350, shows the controlling tracery motives: the division of a vast space into panels of approximately similar size, with arched heads, separated by continuous tiers of horizontal transom bars and vertical mullions. Frequently some of the mullions run continuously through from sill to arch, thus forming a rigid framework that allows windows of almost unlimited size. The east window in Gloucester is 38 feet wide and 72 feet high. Moreover, the ranges of similar arched headed lights are admirable for stained glass figures. The design of the window heads was more difficult, for the intersection of the verticals with the arch line was unpleasant. All sorts of combinations of arched bars with vertical lights are to be found.

The panels of perpendicular tracery are also admirably fitted to wall decoration, and all the larger perpendicular churches have their wall surfaces covered with such tracery, as in the remodeling of Gloucester referred to above, in the remodeling of Westminster by William of Wykeham about 1370; and the Henry VIIth Chapel at Westminster Abbey, begun in 1502.

Another development of the Perpendicular style was the further complication of vaulting ribs. Liernes and tiercerons were added until the entire vault sur-

face was covered with a network of ribs, and the panels between became small enough to span with single slabs of stone, as in Gloucester choir or Sherborne nave, about 1450. This latter example shows the next logical development. All the tiercerons rising from a pier were given the same curvature, so that



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all hard lines of groins were abolished, and each pier supported a vault form of conoidal shape, like half the mouth of a trumpet, small end down. With this multiplication of ribs, the panels grew so small that it was no longer economical to make them separate from the ribs; both were cut out of the same stones. Thus the ribs lost all structural necessity, became mere decorations on the surface of a cut stone vault, and tended to be treated more and more in the spirit of the window tracery. This development produced what is called the FAN VAULT, apparently first used in Gloucester cloister about 1377. It became more and more common and elaborate; the two finest examples are the Henry VIIth chapel in Westminster Abbey, and King's College Chapel in Cambridge, both vaulted in the early 16th century.

Other characteristics of the style are: the use of four centered arches in doors, mantel piece openings, and other places; the frequent enframing of an arched head with a rectangular molded frame, the corner spandrels thus left being decorated with leaves or heraldic shields; a love of verticality and structural expression unknown in England before; the love of pierced battlement forms as crestings, and the gradual disappearance of naturalism in carved ornament.



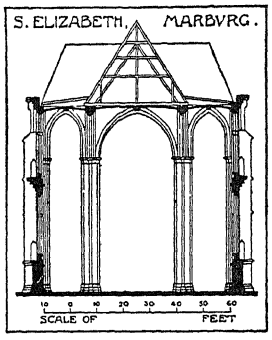
FAN VAULTING
Retrochoir of Peterborough Cathedral

The Perpendicular period coincided with a great increase in the importance of secular activities, as well as a marked development of the amenities of ordinary living. As a result, not only is much collegiate building in Oxford and Cambridge in the Perpendicular style, but also the creation of the English type of large house, with its paneled rooms, its grouped mullioned windows, its many gables, and its rich chimneys, took place entirely under the influence of Perpendicular Gothic architecture. So vivid and vital was this movement, that the Gothic inspiration persisted in England until well into the 17th century.

GOTHIC ARCHITECTURE IN NORTH EUROPE

The Gothic style of the Teutonic lands of the Low Countries and Germany was started entirely under French influence, as can be seen in the early Gothic portions of Strassbourg Cathedral, and in the Cathedral of Cologne. Similarly the cathedrals at Brussels and at Utrecht in Holland are definitely French in type. Yet the Germanic love of picturesqueness and height produced definite changes. The chevet was modified or abandoned, to allow glazing the entire east end of the church. At first, as in the Liebfrauen Church at Trier, begun 1227, and Regensburg, 1275-1309, the windows were in two stories. Later the eastern windows were made of tremendous height and slimness, running from near the floor to the underside of the vault, and producing a stunning effect of airy height, as in St. Sebald's Church in Nuremburg, 1349-70, and the Cathedral at Erfurt, early 14th century. This love of height also led to the German popularity of the so-called Hall Church, in which there are no triforia or clearstories, and nave and aisle vaults both spring from the same level, as in St. Elizabeth, Marburg, 1235-83; the monastic church at Zwetl, 1343; the Frauenkirche, Nuremburg, 1355-61, and St. George at Dinkelsbühl, 1449-90. The Germans also delighted in towers of airy, openwork types. This tendency appears in the work of Erwin Von Steinback on Strassburg Cathedral, where the whole front of the church is covered by a veil of openwork

tracery, about 1325, incredibly delicate, and the twin towers, of which only one was built in the 15th century, are designed in an original treatment of receding stages with delicate openwork corner turrets. In the spire of Freiburg Cathedral, completed in 1288, the pyramid sides are already of pierced openwork tracery. The movement reached its climax in the late Gothic spires, such as the spires of Regensburg, about 1475-1500 by Roritzer, and especially Ulm, 528 feet high, built in the 19th century from 15th century drawings by Böblinger.



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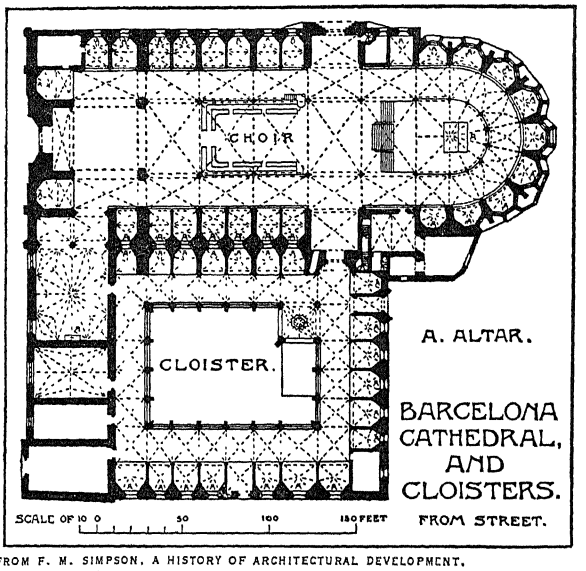
SECTION OF CHURCH OF ST. ELIZABETH AT MARBURG, GERMANY

In flamboyant late Gothic detail the German love of the bizarre found congenial expression, and developed rich and intricate details full of imagination. All sorts of interlacing forms were used, in both vault ribbing and tracery, and naturalistic branch tracery was used. The same love for complicated late Gothic lace work in stone was common in Belgium, the most notable example being the Town Hall of Louvain, 1448-63, destroyed during the World War.

An interesting variant of Gothic forms was developed in the brick work commonly used along the North Sea coast and the Baltic, especially in the Hanseatic cities. The quiet simplicity of the Dutch types may be seen in the Great Church of Haarlem, 15th century, and the New Church of Amsterdam, 15th century. The much richer North German types, with elaborate ribbed vaults in brick, and rich brick tracery are shown in the Marienkirche at Lübeck, 1270-1310, in St. Mary's at Wismar, 14th century, and in the Marienkirche at Danzig, begun in 1403. In certain secular buildings the richness of the brick tracery forms is even more remarkable, as in the Treptower Gate in New Brandenburg, and the elaborate façade of the Town Hall at Tangermünde.

GOTHIC ARCHITECTURE IN SPAIN

The 13th century Gothic of Spain was largely French in character, but an innate love of big scale of the parts, the common use of windows of much smaller size and, in the south, strong Moorish influence towards concentrating rich ornament and contrasting it with plain wall surfaces, all combined to produce rapid changes. Leon, 1204-1303, and Burgos, begun 1221, though the open spires are by a German architect, John of Cologne, and date from 1422, are the most French in type, though on the exteriors both show the flat roofs and plain wall surfaces of Spain. In the later cathedrals love of size produced effects quite different. Seville, the largest Gothic Church in Europe and begun in 1412, gives less the appearance of being the cruciform Gothic church that it really is, than, like the Moorish mosques, an enormous rectangular area with many piers. An important Spanish medieval development was the style called MUDEJAR created by Moorish craftsmen working under Christian domination, and applying Moorish brick decorative paneling, as in Zaragosa tower, 1504, and Moorish skill in elaborate carpentry and joining, especially in ceilings, to buildings for Christian use. In the 14th century a local school of Gothic of great originality and vitality developed in Catalonia. Great scale of parts is characteristic, and an attempt to find new solutions for church schemes. The Cathedral and Santa Maria del Mar at Barcelona, and the nave



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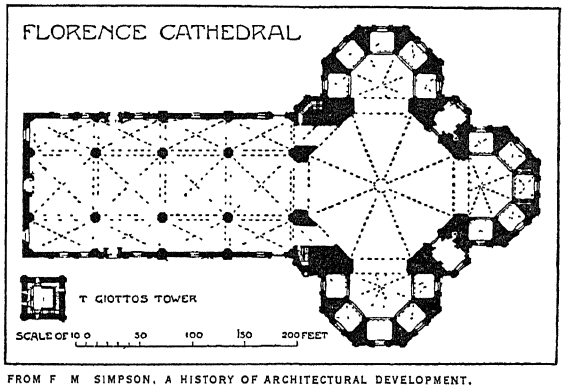
CATHEDRAL AT BARCELONA, SPAIN

of the Cathedral of Gerona, 73 feet wide, are all unique in the independent and magnificent way in which they use Gothic structure and forms to produce an entirely new type of monumental effect. In the late Gothic period, Flemish and German influence were important, and the combination of the Spanish love for concentrated ornament with the Germanic skill in intricate tracery produced the most lavishly extravagant late Gothic forms, imaginative, often contorted, virile, making great use of heraldic forms. Examples are the *cimborio,* or central tower of Burgos Cathedral, early 16th century, and the Portuguese monasteries of Belem and Batalha, 16th century, in which the extravagance and lavishness of all the carved detail is unique.

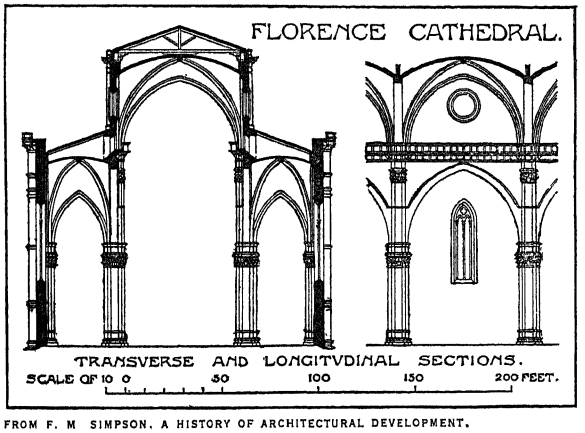
GOTHIC ARCHITECTURE IN ITALY

The persistence of the Roman and Romanesque building tradition throughout Italy prevented any complete acceptance of the French idea of the structural basis of Gothic architecture. A few monastic buildings of the Cistercian order are exceptional. In them the Gothic idea was understood and expressed in a definitely structural way, but they had little effect

upon Italian taste. The great Cathedral of Milan, begun 1387, largely designed and built by Germans, is another exception. The characteristic Italian use of Gothic forms was decorative, playful, nonstructural; pinnacles, crocket gables and cusped tracery were used as free elements of surface ornament. At the same time colored materials were used to give richness. The fronts of Sienna, 1260-67, and Orvieto Cathedrals, 1290-1330, are characteristic in their purely decorative screen gables, their mosaics and banded marbles, their crocketed gables and pinnacles used as wall decoration. The Italian love of big scale in the proportions of a building, and of simple wall surfaces for mural decoration, led to enormous interiors which lack any adequate sense of their own size, such as the interior of the Cathedral of Florence, 14th century. Santa Croce in Florence shows the developed central Italian Gothic in its simple structure, large scale and rich color. The Campanile at Florence, designed by Giotto and his pupils, and begun in 1334, shows the same elements freely combined in an exterior design of great brilliance and superb effect.



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In the late Gothic period a particular school of Gothic design developed in Venice through the application of Gothic pointed arches and tracery to the traditional Venetian Byzantine surface decoration. The Ça d' Oro by G. and B. Bon, 1430, shows the lovely delicacy thereby produced, and the exteriors of the Doges Palace by Baseggio, 1340, the same ideas applied in a more monumental manner. In the 15th century Venetian Gothic reached a climax of fantastic and playful richness well seen in the Porta della Carta of the Doges Palace, built by the Bons in the middle of the 15th century.

SECULAR GOTHIC ARCHITECTURE

Throughout Europe the 13th, 14th and 15th centuries saw a continually increasing importance in organized community secular life. Trade was being developed and systematized. City governments were more and more organized and stable; the feudal system was falling to pieces, and courts being developed on other bases. There was growing wealth and luxury everywhere. In the buildings necessary to take care of these functions, in houses for town and country, even in furniture, the designers and craftsmen used largely the pointed arches, crockets, carving and tracery that had been developed in church building. To these forms they added others equally logical, the beamed floor and ceiling with cross girders, open timber trussed roof construction and the decorative richness of half timber work.

The Town Halls of the period were natural developments from the Romanesque types. In Italy they usually followed the model of the Palazzo with its court, as Palazzo Vecchio, Florence, by Arnolfo, begun in 1294. In France the cathedrals themselves sometimes served as Town Halls, until the 15th century when many separate buildings for this purpose were built, especially those of Orléans, Compiègne, Beaugency and St. Quentin. In these the building is a single block, with a market or minor offices on the ground floor, and meeting halls and a chapel above; there is usually also a belfry. Especially rich developments of the Town Hall are found in Belgium, Holland and North Germany. Sometimes the great halls of the merchants' Guilds were really Town Halls, as in the case of the great Cloth Hall at Ypres, 13th century, destroyed during the World War, but now under reconstruction. Court Houses also reached a high state of development in the 15th century, as in the great Palais de Justice at Rouen. Other important types of official or semi-official buildings of size and beauty were the Synodal Halls like that of Sens; the Bishops' Palaces, like those of Poitiers and Laon, in France, and Ely in England; and such great halls as that of the Royal Palace in Paris, built by Philip le Bel, and reaching the enormous size of 90 feet wide and 232 feet long, with one row of columns and a great timber roof, and Westminster Hall in London, 1394-98, once the great hall of Westminster Palace. (*See* GOVERNMENTAL ARCHITECTURE.)

There are great numbers of 13th, 14th and 15th century masonry houses standing, especially in South France, Spain and Italy, that show the application of Gothic forms to domestic architecture. The houses are usually in a simple rectangular form between party walls; but larger examples have courts. A noteworthy feature is the rich 15th century development

of half timber work in house building, especially in Northern France, England and Germany. T. F. H.

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GOTHIC ART. The Gothic style as structure is treated under ARCHITECTURE, but the spiritual and intellectual force which created its logical framework inspired to an even greater extent the inexhaustible variety of decoration, which covered alike the living flesh and the skeleton of ribbed vault and pointed arch. The great unseen power which gave to Gothic art its flamelike quality, soaring to its full height in the 13th century in France, and spreading with rapidity throughout Europe, must be looked for under the surface of general historical fact. The Christianity of the common people, which had striven to find expression through the clumsy art-forms of the catacombs, and which had remained an underground current for 1000 years, gathering momentum through the ages, in proportion as restraint was placed upon it by the Church, leaped into sudden splendor in France, which had made itself the head of the movement of civilization. Gothic art, filling the interval between the Romanesque era and the RENAISSANCE, was the flowering of CHRISTIAN ART in the medieval age, which was relatively the only spiritual period to be found in history, when for the first and only time Christendom united in a common bond of spiritual sympathy. The stern discipline and powerfully intellectual hieratic art traditions of the monastic orders are described in the article on ROMANESQUE ART. With these carefully imposed restrictions as preparation, when the rising flood of life burst forth, it was able to manifest itself in an unprecedented collective idealism. The national life once strongly aroused, in this richly flourishing civilization, there was a freer and more independent expression in every sphere. The towns, even in remote districts, demanded larger and nobler churches, built to their own stature, and to stand as the center of their life.

While art passed out of the cloister into the commune, it was still devoted to the service of religion and remained under the lofty direction of the Church. Latin, the language of the Church, was scarcely understood by the officiating priests. There was need to give concrete form to abstract thought. Aware of the power of art over the unlettered souls of the faithful, the Church reduced to a symbolic code the full body of its teaching, which once formed and understood could be maintained with infinite variety but fundamental similarity. In a period of intense intellectual activity, it was the practice of the great schoolmen to compile works of universal knowledge; for example, a "mirror of the world" was a phrase of the time, and it was also the title of Beauvais's famous encyclopedia. The latter was divided into natural phenomena, the works of man, legends of the saints and allegories, and scenes from the Bible, all leading up to and consummated in the doctrine of Redemption. An elaborate spiritual and learned scheme was worked out with great simplicity and directness, resulting in a new conception of beauty, yet with nothing new added, save the intuitional genius of the medieval artist, who delighted in nature for its own sake. He was a realist in the highest sense; while perfectly imitating nature, he developed the principle of decoration. Under the guiding hand of the theologian he was free to create the flora and fauna that came to life under his hand. A flora motive was often carried round the whole pier and again concentrated in a general mass, but always the design corresponded to the graceful proportions of the pillars, unlike the stiff rectangular forms of the Romanesque.

The cathedral builder, a pious man, might put into material form the vision of his faith, but he alone could never have devised the learned compositions of bas-reliefs and windows in which each episode is accompanied by its symbolic meaning. He might give naturalistic expression to his figures, but always formed on principles regulated by the Church. Aside from the didactic intent of decoration, the beautifying of the house of God was for the glorification of the faith. Suffering was not dwelt on, madonnas were not gaunt and grief-stricken but willowy, expressing a radiant purity, while Christ looked down from the cross in serene majesty. The naturalistic sculptural decoration of the Gothic age had a functional relation to the organic structure growing out of architectural requirements. Each figure, fashioned from the same stone as the edifice, strangely proportioned, with few conventionalities, loses half its value when removed from the surroundings with which it harmonizes. In every part of the vast building, both inside and out, bas-reliefs and statues were introduced. In the Cathedral at Chartres there are 10,000 personages in stone and painting. The lacelike delicacy of stone carving was contrasted with that of wood, wherever it could be used in choir stall and screens. Ivory was much prized, a luxury and intrusted only to the finest artists. Some of the most exquisite carvings of medieval Europe were ivories for private devotions or the liturgical ceremonies of the Church. The small crucifix and the figure of the Virgin were also of ivory, when that material was available.

The Gothic style is characterized by the desire for light. The heavy low Romanesque walls mounted into vertical slender lines, pierced in every part with rose windows and high broad bays filled with glowing stained glass, filled the edifice with a warm radiance in which the rays of the sun took on the colors

of the rainbow. The purpose of the stained glass was not to shut out but to glorify the sunlight, and it gave a brilliance and beauty which no fresco or mosaic could have attained. The walls became great luminous shrines shot through with flames in constant and ever charming changes. The technique of stained glass window painting and construction is set forth in great detail by the monk Theophilus. All available wall space was covered with frescoes, characteristically Byzantine, with gold or solid color background, and figures confined in compartments. Both the interior and exterior of the churches were richly colored and gilded in their ornamental detail. In a chivalric and conventional age, where embroidery was the crowning accomplishment of womanhood, magnificent tapestries were hung in the arches above the choir-stalls. The vestments of the clergy and the altar hangings were encrusted with the richest embroidery. To add to the resplendent effect, the altar vessels of gold and silver were set with gleaming jewels. If the church was the story-book of the poor, the illuminated missals and Books of Hours were that of the rich. Medieval painting was centered in these ILLUMINATED MANUSCRIPTS.

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GOTHIC REVIVAL STYLE, in architecture and the decorative arts, a style resulting from the widespread neo-medievalism of the middle 19th century, itself a result of the Romantic movement characteristic alike of Germany, France, England and the United States. Its first example was probably Sir Horace Walpole's "Strawberry Hill," a picturesque house richly decorated with fantastic ornament in a pseudo-Gothic style. From that time on numerous great English country houses were built in a Gothic style. This first phase, picturesque and superficial, was followed by a second phase, that of serious archeology, and the attempt to recreate the Gothic style as the only suitable style for modern churches, an attempt closely bound up with the OXFORD MOVEMENT. In England and America this second phase produced many excellent though academic church designs of serious beauty, as Trinity Church by Richard Upjohn, 1839-46, and Grace Church, by James Renwick, 1843-46, both in New York. The greatest secular building of the English Gothic Revival is the House of Parliament, Westminster, by Sir Charles Barry, 1840-50.

In France and the Germanic countries, the Gothic revival period was chiefly occupied with the restoration and completion of medieval Gothic buildings, as Notre Dame at Paris, restored; Ulm and Cologne cathedrals, completed. The keen sense of structure and of history evidenced by Viollet-le-Duc enabled him, in the *Dictionnaire raisonné de l'architecture française* to produce a work that is still authoritative.

Through the critical efforts of Ruskin and the influence of the craftsmanship ideals of William Morris, the archeological phase of the Gothic Revival gradually yielded in England and the United States to a more free and honest attempt to express modern buildings in terms of modern problems and materials, and yet in harmony with Gothic ideals. The result was the style usually known as Victorian Gothic. (*See* VICTORIAN STYLE.) In France, a similar change due to the basic rationalism of Viollet-le-Duc led to a freer romanticism, often based on Romanesque and Byzantine precedents. For bibliography *see* MODERN ARCHITECTURE.

GOTHS, a Teutonic people who inhabited the central Vistula basin in the 1st century. Originating probably in Sweden and the island of Gotland, they conquered Eastern Pomerania, Holstein and South Russia, penetrating into Scythia, Greece and Asia Minor. In the 3rd century they reached the Danube and came into conflict with Rome. Here they became known as East or Ostro-Goths, who inhabited the region north of the Black Sea, and the West or Visi-Goths, who dwelt north of the Danube. About 370 the East Goths were conquered by the Huns, under whose suzerainty they remained until the death of Atilla. In fear of the Huns the West Goths asked and received permission to enter the Roman Empire in 376. Two years later they defeated the Romans at Adrianople. In 381 Theodosius the Great made terms with them, but before the end of the century they were again on the march and besieged Rome in 408, 409 and 410, the third time sacking the city. Alaric's successors renewed their connection with Rome, and as Foederati established a Gothic kingdom in Southern Gaul and in Spain. Goths and Romans fought together against the Huns at Chalons in 451. Theodoric the Great, King of the Ostro-Goths, conquered much of Italy, which he made the center of a powerful kingdom and which as a Gothic king he ruled under Roman law. During Justinian's reign the Gothic name disappeared from Italy. The Visi-Gothic state fell before the attacks of Franks and Saracens.

GÖTTERDÄMMERUNG, DIE, an opera by RICHARD WAGNER, one of a cycle of four music-dramas; *see* NIBELUNGEN, RING OF THE.

GOTTFRIED OF STRASSBURG, 13th century Middle High German poet, called in German Gottfried von Strassburg, flourished at Strassburg about 1210. Strongly influenced by the French poet, Thomas of Brittany, he composed most of the courtly German epic TRISTAN, which was continued by Ulrich of Türheim in 1235 and finished by Heinrich of Freiberg in 1290.

GÖTTINGEN, a German city in the state of Hanover, situated on the Leine River about 60 mi. south of Hanover. The inner city, with its 16th century houses, is surrounded by wall promenades and parks. One of the Gothic churches is now a university building. The George-August University with its libraries, observatory, collections and experimental stations is noteworthy. It produces physical and optical instruments and food products. The Handel

Opera Festivals have gained prominence. Göttingen was mentioned in 953, was a Hanseatic city a short time, declined in importance but revived upon the founding of the university in the 18th century. Pop. 1925, 41,228.

GOUCHER COLLEGE, a privately controlled institution for women, at Baltimore, Md. It was founded in 1884 as the Woman's College of Baltimore by the Baltimore Conference of the Methodist Episcopal Church. In 1910 the name was changed to Goucher College in honor of the Rev. John Franklin Goucher and his wife, Mrs. Mary Cecilia Goucher, whose generous contributions greatly aided the foundation of the institution. Dr. Goucher also helped organize the college and was its president from 1890-98. The college offers courses in arts, literature and science. In cooperation with JOHNS HOPKINS UNIVERSITY, a college course for teachers and graduate courses are offered under the faculties of both institutions. Goucher had productive funds in 1931 amounting to $2,434,782. The library contained 55,669 volumes. In 1931-32 there were 806 students and a faculty of 103, headed by Pres. DAVID A. ROBERTSON.

GOUDA or **TER-GOUW,** a city in the Dutch province of South Holland, located on the Gouwe and the Yssel, has an ancient aspect, with its broad canal streets. Among the churches is the large Church of St. John with 44 stained-glass windows, a city hall and a municipal library. Clay pipes, candles, cigars, cord and yarn are manufactured. Butter and cheese are traded. Pop. 1930, 29,172.

GOUGE, a CHISEL with a blade having as its cross section the arc of a circle. It is used for cutting round-bottom grooves in wood either when pushed by hand, driven with a mallet or held against a piece revolving in a lathe. Some gouges have the bevel of the cutting edge on the inside but the majority are beveled on the outside. Gouges are also used in surgery for removing part of a bone.

GOUGH, JOHN BARTHOLOMEW (1817-1886), American temperance lecturer, was born at Sandgate, Kent, England, Aug. 22, 1817. He emigrated to the United States at the age of 12. At the age of 25 he was a confirmed drunkard, but signed a pledge at a temperance meeting in New York City, and became an ardent temperance worker. Gough lectured extensively in the United States and England, and obtained more than 300,000 pledges in lectures before audiences which he estimated totalled 9,000,000 persons. In 1845 he published his *Autobiography, Orations and Temperance Addresses* and *Sunlight and Shadow* in 1880. He died at Frankford, Pa., Feb. 18, 1886.

GOUIN, SIR LOMER (1861-1929), Canadian statesman, was born on Mar. 19, 1861, at Grondines, Quebec. He studied at Laval and McGill University. He was admitted to the bar in 1884. In 1897 he was elected to the provincial legislature. From 1905 to 1920 he served as premier of the dominion and attorney general of the province. In 1921 he was minister of justice. He represented Canada at the fourth assembly of the League of Nations and in 1924 at the Imperial Economic Councils in London. He was made an officer of the Legion of Honor in 1907 and was knighted in 1908. He died at Quebec on Mar. 28, 1929.

GOULD, JAY (1836-92), American financier, was born at Roxbury, N.Y., May 27, 1836. He began his career as a surveyor, engaged in the lumber business, and in 1857 became interested in banking. His first important financial move was the purchase of the bonds of the Rutland & Washington Railroad, which he united with the Rensselaer & Saratoga line. He sold his interests, and moved to New York City, where with James Fisk he won control of the Erie Railroad. His most sensational in a series of speculative coups was his corner, in association with Fisk, of the gold market in New York City. This ended in the panic of Sept. 24, 1869—"Black Friday." Gould obtained control of the Union Pacific, which gave the "Gould System," in 1880, a total of 10,000 miles of track. Later he gained control of the Western Union Telegraph System and then of the New York City elevated railroads. He died at New York City, Dec. 2, 1892.

GOUNOD, CHARLES FRANÇOIS (1818-93), French music composer, was born at Paris, June 17, 1818. A student at the Paris Conservatoire, he won the Prix de Rome in 1837 and the Grand Prix in 1839. His opera *Sapho* was produced in 1851, but he failed to win wide recognition until the production in 1859 of *Faust,* which instantly established his reputation, and remains the work which to this day chiefly sustains it, being more highly regarded than his only other successful opera, *Romeo et Juliette,* produced in 1867. His oratorio *The Redemption* and his short cantata *Gallia* should be mentioned among his successful excursions into the domain of ecclesiastical music. He died at St. Cloud, Oct. 18, 1893.

GOURAUD, HENRI JOSEPH ÉTIENNE (1867-), French general, was born in Paris, Nov. 17, 1867. He obtained his military training at St. Cyr, served in Africa in 1894-1914, and on the outbreak of the World War was made a division general in the Argonne. In 1915 he commanded an expeditionary force in the Gallipoli campaign, in which he lost his right arm. He was given command of the IV Army late in 1915, and retained his command until Sept. 1919, except for a period of six months in 1916-17 when he served as resident-general of French Morocco. In July 1918, Gouraud cooperated with Pétain in a "coil-spring" defense against the fierce German offensive, and contributed much to the defeat of the last major German campaign. In the year following the Armistice he was appointed high commissioner of Syria and in 1924 became military governor of Paris.

GOURD (*Lagenaria leucantha*), a long-running annual vine of the gourd family (*Cucurbitaceae*), believed to be native to the tropics of the Old World but now widely cultivated and naturalized in warm countries. It is a musky-scented, sticky-hairy trailer

with branching tendrils, large roundish leaves, sometimes a foot wide, and showy white flowers, 2 to 4 in. across, which wither about noon. The large hollow fruits covered with a hard durable shell, range from 3 in. to 3 ft. in length. They also vary remarkably in shape from nearly spherical and bottle-shaped to disk-like, clublike and dumb-bell-like forms, some of which are crook-necked and coiled. The shells are used for drinking-cups, ladles and other utensils. Among the numerous varieties are the sugar-trough, Hercules-club and dipper gourds. The yellow-flowered gourds, much grown for ornament, are forms of *Cucurbita Pepo;* they are mostly small fruits, sometimes used for darning balls.

GOURLAY PERSECUTION. Into Upper Canada in 1817 came Robert Gourlay, a Scottish gentleman, eccentric, who determined to establish himself as a land-agent. To gather data for advertising matter to be distributed in England, he sent to various townships in Upper Canada a list of questions, mostly relating to schools and churches, wages, resources, etc., but including: "What, in your opinion, retards the development of your township in particular, or the province in general?" Affronted by this questionnaire and subsequent correspondence, wherein Gourlay recommended the sending of commissioners to present grievances to the home government, the FAMILY COMPACT initiated action against him for libel, in Kingston; Gourlay was acquitted in jury trial. In Brookville similar action resulted in acquittal. In a third attempt the oligarchy made use of the Sedition Act of 1804, whereby any person less than six months in the province was liable to arrest for "seditious intent." Gourlay was thrown into prison to await trial seven months later. At his hearing, in Aug. 1819, before the Chief Justice at Niagara, Gourlay was plainly emaciated and of disordered mind; none the less he was virulently prosecuted, and condemned to exile. Popular resentment at these proceedings was a factor in the growth of the reform party.

In 1836 he was vindicated, when his sentence was declared illegal.

GOURMONT, REMY DE (1858-1915), French writer, was born at Bazoches-en-Houlmes, Department of Arne, Apr. 4, 1858. He was librarian of the Bibliothèque Nationale, but in 1891 was dismissed for writing *Le joujou patriotisme.* His work is voluminous, his vast erudition rendering him especially successful as a literary and philosophical critic. He was a founder of the *Mercure de France.* Included among his novels, which are analytical, cold, masterly in style, are *Le Pelerin du Silence,* 1896, *Une nuit au Luxembourg,* 1906, and *Un Coeur Virginal,* 1907. *Le Problème du style* contains some of his best criticism; *Divertissements,* 1912, is a volume of subtle poems. Gourmont also wrote two plays, *Lilith,* 1892, and *Theodat,* 1893. He died at Paris, Sept. 27, 1915.

GOUT, a disease caused by the precipitation of crystals of sodium biurate in the joints and in other localities. The condition is fairly common in Europe, especially in England, but rare in the United States. It affects middle aged persons, generally men, who lead a luxurious life and eat rich food.

The sodium biurate results from the abnormal transformation of food molecules of a certain type called purins, present especially in meat, coffee, and tea. Normally the excess of purins in the body are eliminated by the kidney as URIC ACID. As a result of changes within the kidney, it is unable to excrete uric acid, this accumulates in the blood, becomes modified and is deposited.

The joints usually affected are the great toe, thumb, foot, and wrist. The symptoms arise from the physical irritation of the crystals. Treatment consists in modifying the diet so as to reduce purins, and in increasing the amount of exercise. Liver, game, pastry, tomatoes, strawberries, coffee and alcohol should be excluded; and milk, eggs, and starchy foods substituted.

With proper care, the disease may be limited to a single attack; on the other hand, it may recur for years. *See also* PERICARDIUM, DISEASES OF.

GOVERNMENT, the agency through which the STATE exercises political control. In every organized society there is a definitely determinate body with powers of coercion to which the overwhelming mass of the population renders obedience. This determinate body is the government. The origin of the government is wrapped in the same mysteries which cloak the origin of the state. A number of theories have been developed, chief among these are the theory of divine origin, the theory of the great law giver, the compact theory, the patriarchal and matriarchal theories, the theory of force and finally the theory of historical evolution.

ARISTOTLE classified governmental organizations on the basis of the number of people exercising authority. Thus, if the sovereign power rests in one individual the government is a monarchy; if on the other hand it is intrusted to a small group, it is an aristocracy; and finally, if the great mass of adult male citizens participate in the process of government, it is in Aristotle's classification a commonwealth. He attempted further to differentiate between the good and the bad aspects of the various forms of governmental organization on the basis of motives of the ruling class. Thus, a monarch who rules in his own interests rather than in those of the state, he labels a tyrant. An ARISTOCRACY which subverts its power to its own ends is an oligarchy. And a popular government in which the mass of the voters place their own private interests above those of the state does not deserve the name of commonwealth but rather that of democracy. The classifications of Aristotle's still stand, although the distinction between commonwealth and democracy is largely ignored.

In popular usage any government having an hereditary monarch at its head, even though its legislature rests on a broad popular base, is considered a monarchy. Historically, a monarch may rule by either

hereditary right or by right of election. A much more fundamental test than inheritance is that of tenure. The tenure of a monarch is for life. A further distinction must be made between absolute monarchies and limited ones. No example of the former remain in the European world to-day and but one or two in Asia or Africa. Last of the outstanding despots, perhaps, was NICHOLAS II, Czar of all the Russias. The existing European monarchies are all of them distinctly limited and possess powerful legislative bodies which are sovereign in their own domain. In reality all governments are mixed. Even in the so-called DICTATORSHIPS which, with the exception of the United Soviet Republics of Russia, constitute the most outstanding postwar development in government organization in Europe, great dependence must be placed upon the party or military caste which constitutes the real power in the particular state.

Aristocracies also fall into various categories. They may be aristocracies of land, or other form of wealth; of birth; of official position; they may rest upon a military background; or they may be a combination of any or all of these elements. Although in theory the aristocratic form of government has followed the absolute monarchy into desuetude in the western world, there are many aristocratic influences present in the workings of the modern state.

A still further differentiation must be made between pure democracies and democratic republics. In the former the state is managed by the voting population convened in political assembly. This form of organization obviously is applicable only to small communities. In representative democracies, or democratic republics, the final decision relative to matters of public policy is delegated to popularly chosen representatives who act for the body politic, who in most cases may be reversed in their decisions by ensuing representative assemblies likewise chosen by the voters.

Only by a detailed analysis of a particular governmental structure is it possible to indicate the exact category or set of categories to which any modern state belongs. And in most cases it will be discovered that they possess what is known as a mixed government, i.e., one based on a mixture of the principles which have been analyzed in the paragraphs above. Thus the British Empire, although a monarchy, is also a democratic republic, with at least the vestigial remains of an aristocracy in its composition. The United States, although essentially a representative democracy, possesses in its Supreme Court certain elements of aristocracy, and in its independent executive many of the characteristics of a monarchy.

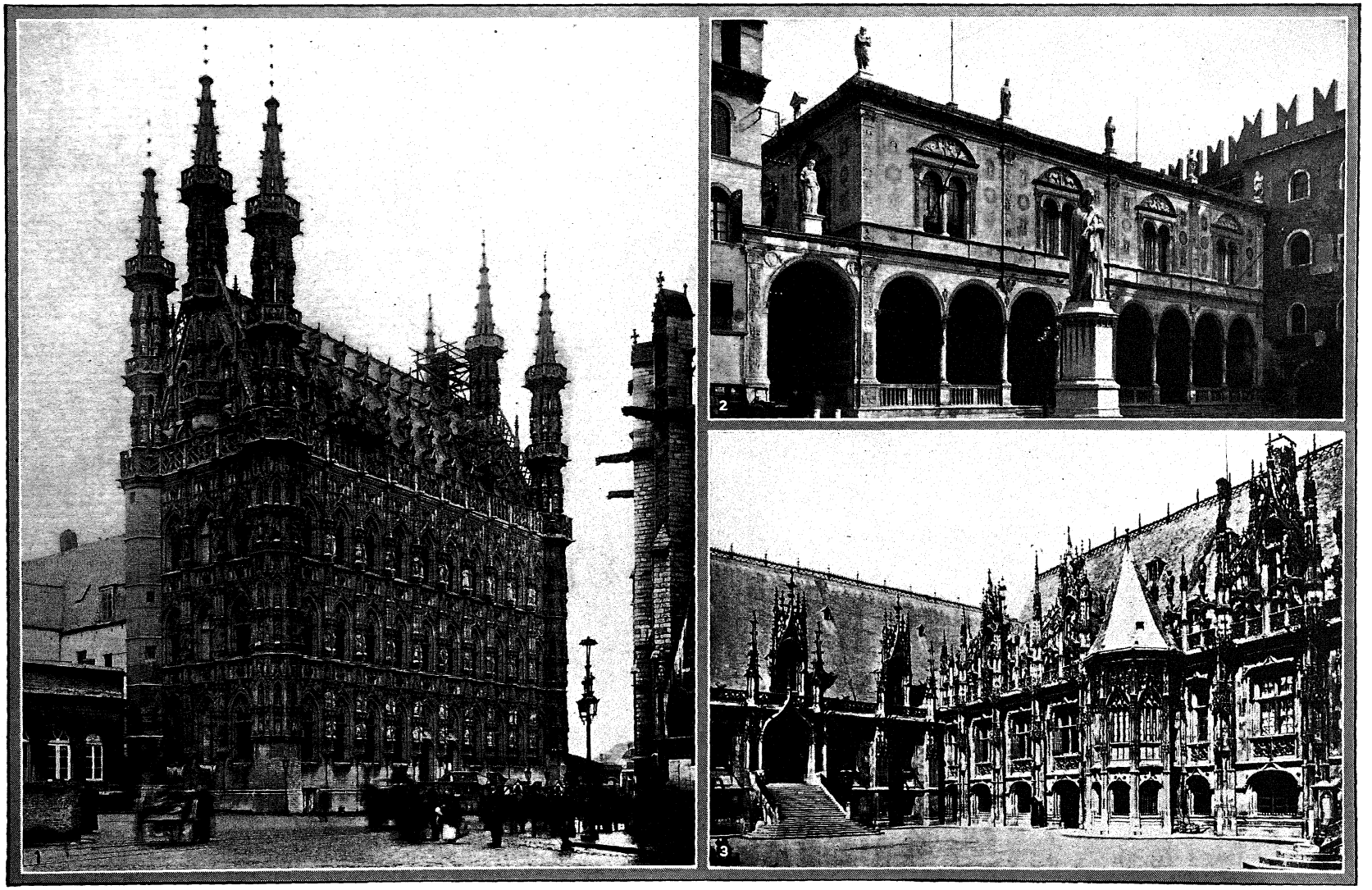
A still further differentiation should be made between the two major types of governmental organization which have developed among representative democracies in the modern era—viz., the presidential and the cabinet form. *See also* PRESIDENT; CABINET; PARLIAMENT.

Equally important among governmental classifications are those which are based upon the geographic distribution of power. Upon this basis three major categories are discernible—unitary, Federal and confederate. If the powers of government are concentrated in a central body from which all local and state governing authorities derive their existence, such a government is unitary. If on the other hand this authority is by constitutional mandate divided between a central governing agency and a number of local units, the government is Federal. In such a government, each governmental agency has marked out for it a definite sphere of action. The central government in a confederation is merely the agent of the members of the confederation, with its jurisdiction exceedingly limited—usually including only such matters as foreign affairs, national defense and, possibly, the regulation of certain trade matters of interstate concern. Each state in a confederation retains practically its complete sovereignty, including the right to withdraw from the confederation. S. C. W.

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GOVERNMENTAL ARCHITECTURE, the architecture of those buildings specifically designed for the legislative, executive, or judicial functions of government. The earliest governmental buildings were merely portions of royal palaces in autocracies, developments of the temple in theocracies, or the great hall of a communistic dwelling in such tribal governments as those of the five nations among the American Indians or among various African and Melanesian peoples. Developed governmental architecture, as a separate building type, arises only where a developed civic life and at least a partially democratic ideal prevail. This was notably the case among the ancient Greeks and Romans. Thus, the Greek cities had commonly a *prytaneum* and a *bouleterion* closely associated, usually near the *agora* or town center. The *prytaneum* was the official residence of the priest of the local divinity and frequently preserved primitive hut forms; in historic times it was the official center of town life. The example at Olympia is a complex building of various halls for public banquets and the like. The *bouleterion* was the council house. Various examples exist, of which the most typical is that of Priene, a nearly square building with seats around three sides and an open space in the center for the speaker.

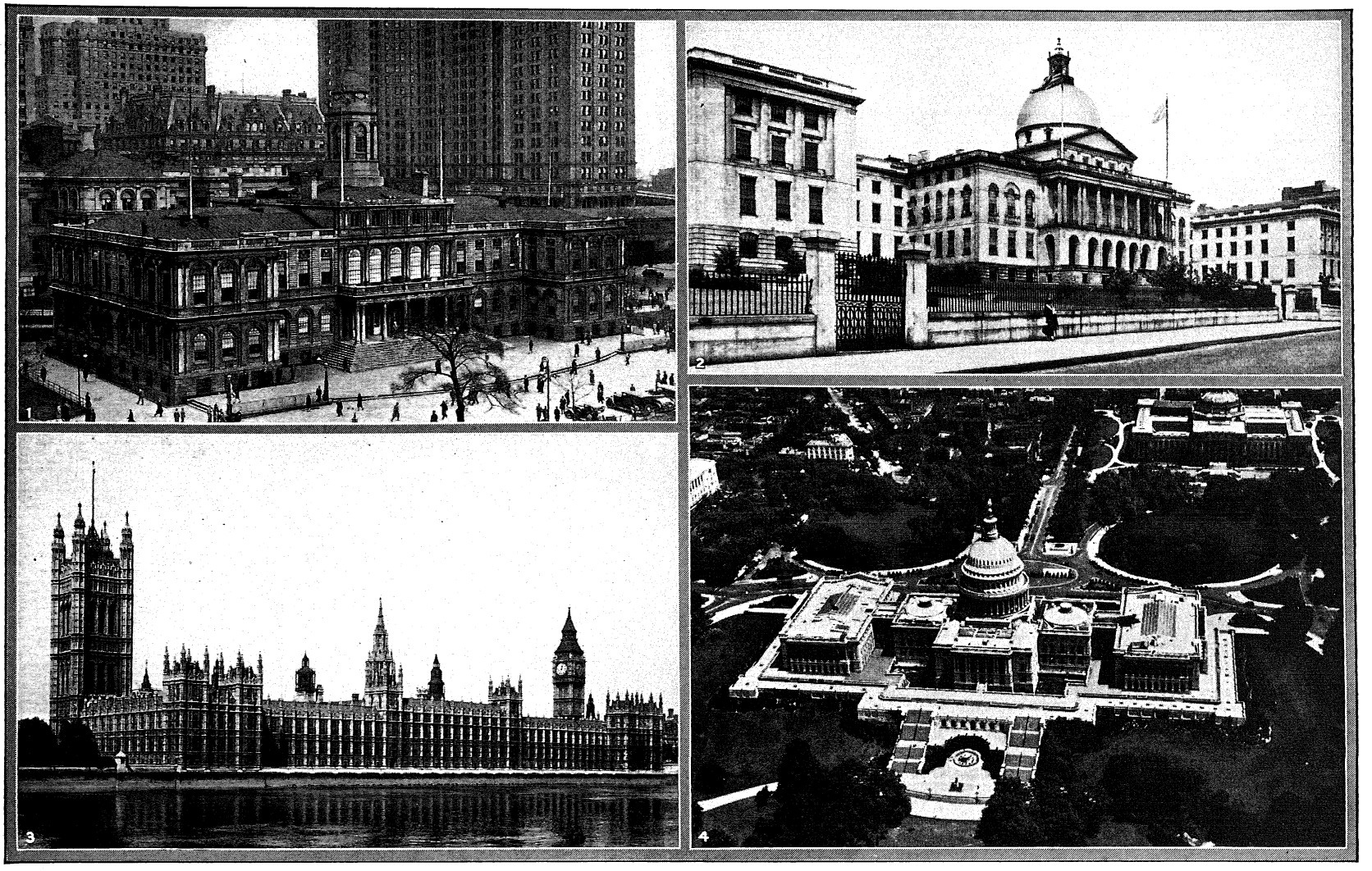
In Rome, the Regia took the place of the *prytaneum.* Closely associated with the House of the Vestals and the ever-burning fire which they maintained, it formed the official residence of the high priest, and on its walls were carved the official records. The *bouleterion* is represented by the Roman Curia, which in Rome takes the form of a three-aisled hall with an apse at the end, in which stood a statue of Victory. At one side, two other halls, probably used as offices, gave access to another hall, or committee room, known as the *secretarium senatus.* At one side of this building, on the face of the Capitoline Hill, was the magnificent building for the national archives, called the *tabularium,* whose arcades opened out above the end of the Forum. Across the Forum, the treasury was



1. COURTESY CONSULATE GENERAL OF BELGIUM; 2, EWING GALLOWAY PHOTO

MUNICIPAL BUILDINGS OF CONTINENTAL EUROPE

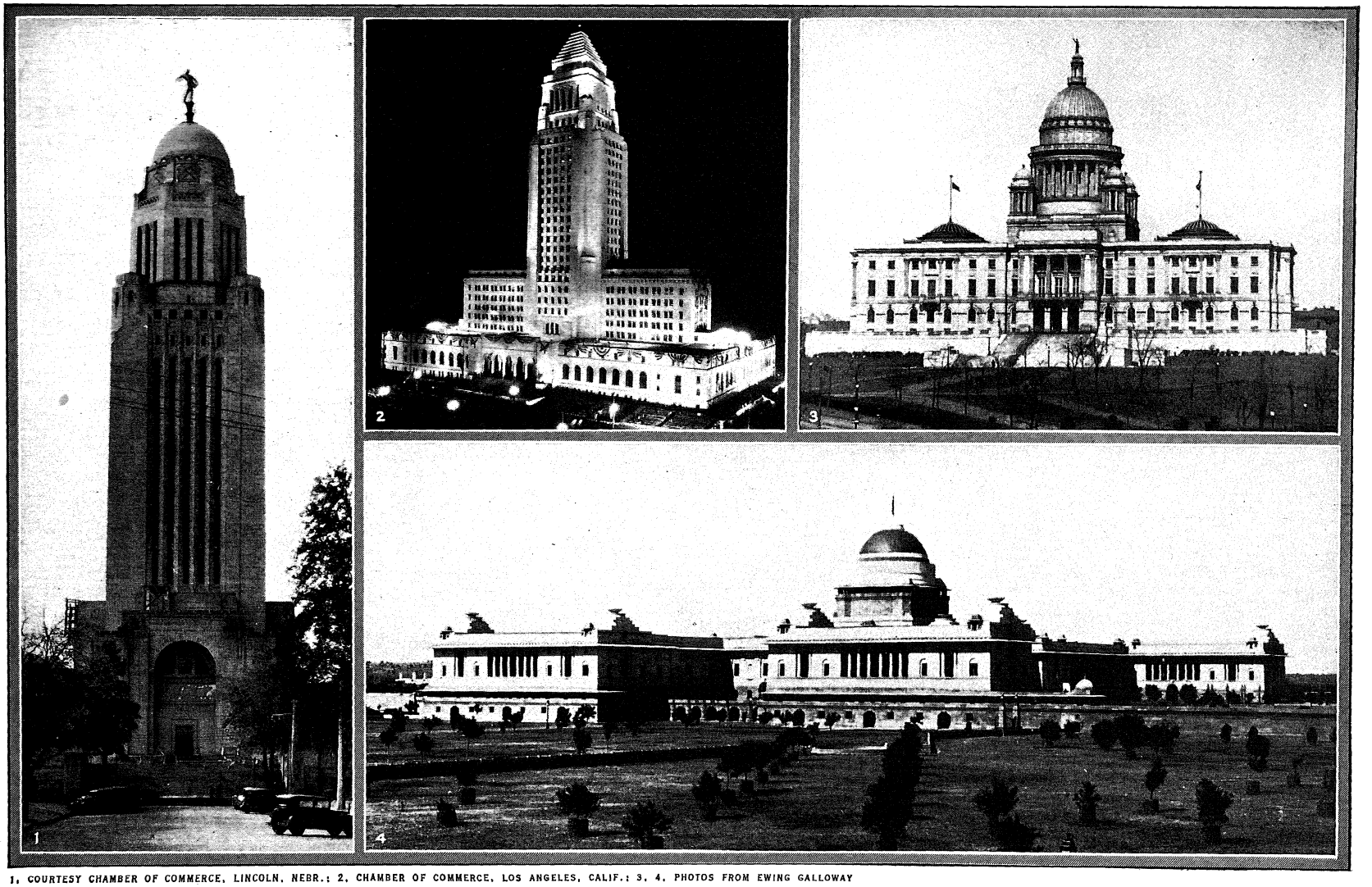
1. Hôtel de Ville, the city hall of Louvain, Belgium, an example of late Gothic architecture built during 1448-59. **2.** Palazzo del Consiglio, or the Old Town Hall, sometimes called La Loggia, at Verona, Italy, an early Renaissance building. Fra Jocondo, Architect. **3.** Entrance court of the Palais de Justice, Rouen, France. 15th-16th centuries.



1, 3, ACME PHOTOS; 2, 4, EWING GALLOWAY PHOTOS

MUNICIPAL AND NATIONAL GOVERNMENT BUILDINGS IN ENGLAND AND AMERICA

1. City Hall, New York, New York, 1803-12. John McComb and J. F. Mangin, Architects. **2.** State House, Boston, Massachusetts, 1795-98. Charles Bulfinch, Architect.
3. Houses of Parliament and Westminster Hall, London, England, 1840-68. Sir Charles Barry, A. W. Pugin and Edward M. Barry, Architects.
4. National Capitol, Washington, D.C., 1793-1830. W. Thornton, Stephen Hallet, B. H. Latrobe, Charles Bulfinch and Thomas U. Walter, Architects.

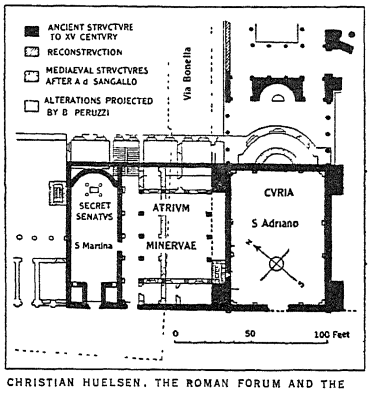


1, COURTESY CHAMBER OF COMMERCE, LINCOLN, NEBR.; 2, CHAMBER OF COMMERCE, LOS ANGELES, CALIF.; 3, 4, PHOTOS FROM EWING GALLOWAY

MODERN STATE BUILDINGS

1. Nebraska State Capitol, Lincoln, Nebraska. The massive central tower is 400 ft. high. B. G. Goodhue and the Goodhue Associates, Architects.
2. City Hall of Los Angeles, California. Parkinson and Martin, Architects. 3. Rhode Island State Capitol, Providence, Rhode Island. McKim, Mead and White, Architects.
4. The Viceroy's House, New Delhi, capital of India. Sir Edwin Lutyens, Architect.

located in the Temple of Saturn, so that all the functions of government were closely related. In Pompeii, a smaller apse-ended curia stands at one end of the Forum, flanked by two similar but smaller halls which



CHRISTIAN HUELSEN, THE ROMAN FORUM AND THE PALATINE, G E STECHERT & CO

PLAN OF THE CURIA JULIA, OR HOUSE OF THE ROMAN SENATE

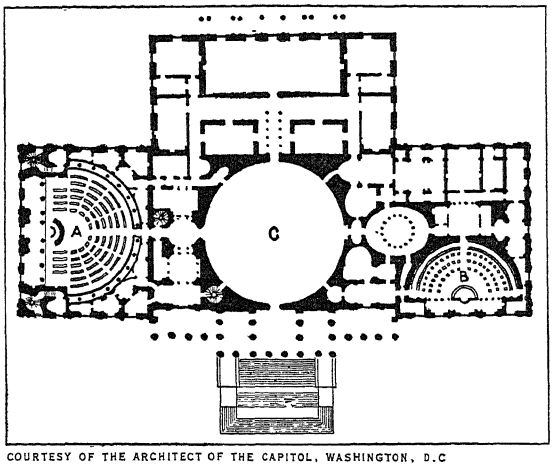
were the offices of the *duumvirs* and *aediles*. The *comitium*, or voting place, was close by. In all the important Roman cities, these buildings are usually placed close to one or more basilicae, which were largely used as law courts.

The Middle Ages. The development of organized town life from the 12th century on led at once to the building of town halls. In almost all cases, outside of Italy, these were two-story buildings with one or more great halls on the second floor and offices below; a belfry was universally attached. French examples frequently have three stories, the first being open to the air and used as a market. Good examples exist at St. Antonin and La Réole, both 12th century; St. Omer, 14th century; and St. Quentin, 16th century, in which the market has been omitted. In Flanders and Germany, particularly in the Hanseatic towns, the town hall was frequently also a guild hall of one of the important merchants' guilds, and these are frequently larger and more luxurious than the French examples. Characteristic examples are those at Ypres, 1200-1304, destroyed during the World War; Arras, 1494, and Ghent, 1533; in Germany, Lübeck, 13th century; Brunswick, 14th century, and Tangermünde, 1375. Italian town halls often served as the residence of the town captain, chief magistrate, and sometimes as prison; they are usually built around a court like noblemen's houses. Sometimes there is both a town hall and a bargello, e.g., Florence, Palazzo Vecchio, 1298, and Bargello, 1256. Other typical examples exist at Sienna and Padua, where the great meeting hall is nearly 90 feet wide and 267 feet long.

Another type of medieval government building was the courthouse or *palais de justice*, which became necessary with the development of secular law. An early 13th century example exists in Meaux, and the Maison de Pierre at Chartres was originally a 14th century courthouse. In both of these the plan is of the simplest. The Palais de Justice at Rouen, end of the 15th and beginning of the 16th centuries, is a much more magnificent building. It enclosed not only various courtrooms but also a chapel and an enormous salle commune.

Renaissance. While, in the north of Europe, Renaissance governmental building tended merely to develop medieval traditions of plan and arrangement, in Italy the change in style brought greater differentiation. Thus, even in the early Renaissance, the beautiful Palazzo del Consiglio at Verona, by Fra Giocondo, has a simplicity and directness of design that makes it utterly different from the houselike town halls of the Middle Ages. Michelangelo's Palazzo del Senatore, on the Capitol Hill in Rome, is another important example of this tendency. Significant Renaissance examples from North Europe are those of Bremen and Augsburg, both of the 16th and early 17th centuries.

Modern: Federal or State. The beginning of modern governmental architecture was undoubtedly the building of the national capitol at Washington,



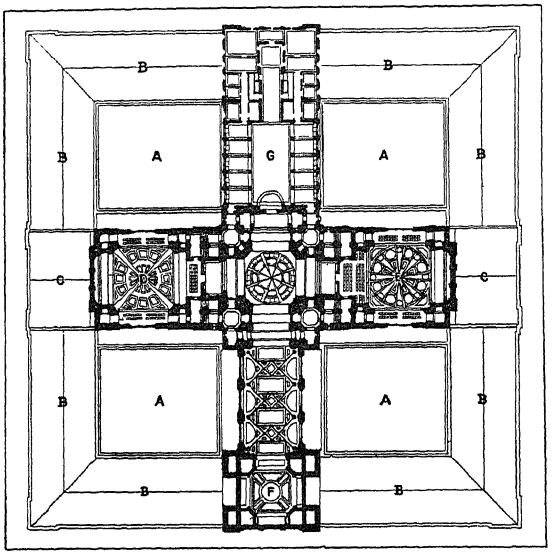
COURTESY OF THE ARCHITECT OF THE CAPITOL, WASHINGTON, D.C

PRINCIPAL FLOOR OF THE NATIONAL CAPITOL, WASHINGTON
A, *Statuary Hall (old House of Representatives chamber)*; B, *Supreme Court (old Senate chamber)*; C, *rotunda*

D. C., for which a competition was advertised in 1792. The building was carried to approximate completion in 1835, by Dr. William Thornton, who had won the competition, succeeded by Stephen Hallet, B. H. Latrobe, and Charles Bulfinch. In this building, for the first time, two halls for a higher and lower legislative body were placed in distinct wings, separated by a rotunda; moreover, in both meeting halls a semicircular plan of ancient theater type was adopted. Both this plan type and the general scheme of the building have had an immense effect in Europe as well as in this country. Even so different a building as Sir Charles Barry's Houses of Parliament in England, 1840-50, shows this influence in the position of its two houses; and the French Chambre des Deputés, in the form given to it by De Joly in the '20s, adopted the American amphitheater plan. In the Parliament Buildings at Vienna, by Hansen, 1874-83, though

there is no dome, the plan is still of the usual capitol type; and the Hungarian Parliament at Budapest, by Steindl, 1893-1902, is merely an attempt to dress the Washington scheme in Gothic clothing.

The same type has been almost universal in American state capitols, as in that of Rhode Island, by McKim, Mead & White; Missouri, by Tracy, Swartwout & Litchfield; and of Minnesota, by Cass Gilbert. The Nebraska State Capitol, by Bertram Goodhue,



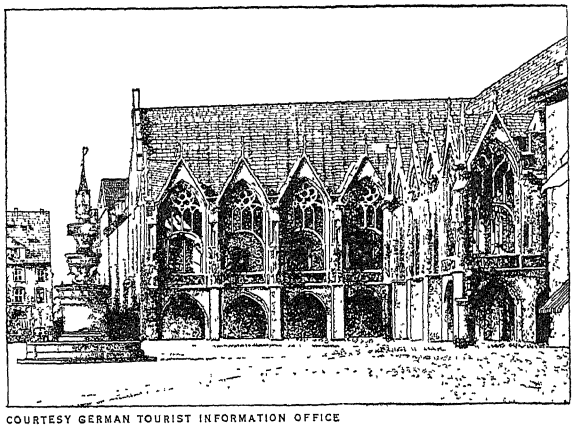
CLERESTORY OR LEGISLATIVE FLOOR PLAN OF THE NEBRASKA STATE CAPITOL. BERTRAM G. GOODHUE, ARCHITECT

A, *Interior court;* B, *roof for lower offices,* C, *roof over House and Senate lounges,* D, *Senate chamber,* E, *House chamber;* F, *entrance foyer;* G, *library*

abandons the dome scheme in favor of a generally square plan enclosing four large courts. An entrance, great vestibule, rotunda, the two legislative houses, and the governor's suite occupy the cross thus developed; above the center rises a great tower.

Town and City Halls. In the Hôtel de Ville, built in Paris for Francis I, by Domenico da Cortona, a new type of city hall appeared, in which great halls for city receptions and monumental staircases were added to the original medieval requirements. The present Hôtel de Ville is a much enlarged reconstruction of the original, which was destroyed during the Commune; its gorgeously decorated Salles des Fêtes and banquet room set a fashion for the European town hall which has remained dominant ever since. There is scarcely a French town of importance without a beautifully conceived and richly decorated town hall in which the same ideas are present, although in a more modest way. The finest is that at Tours, by Laloux, 1896-1904. Many English examples tend toward the same type, though different in style; for example, Manchester Town Hall, by Waterhouse, 1868, and Oxford, by Hare, 1897. The best of the modern German city halls are extremely radical in design. A characteristic example is the Rathaus at Rustringen, by Fritz Höger, with its bold handling of interesting brick and the daring use of blue and gold tile.

The best of the early American town halls is undoubtedly that of New York, 1802-09, designed by a



COURTESY GERMAN TOURIST INFORMATION OFFICE

TOWN HALL OF BRUNSWICK, GERMANY

Frenchman, J. F. Mangin, and the American, John McComb, and carried out by the latter. Its exquisite detail and the unusual skill of its monumental planning, with a rotunda stair hall, all combine to make it unique. Many modern city halls have followed it in general plan, though in the East a more Colonial style treatment has been preferred. The City Hall of San Francisco, by Bakewell and Brown, is unusual in its attempt to express the greatness of a modern city by a building of almost capitol proportions, with a monumental dome. The enormous increase in administrative functions of the modern municipal government has often forced the building of large municipal office buildings in addition to the town hall proper. Few successful attempts to combine the whole into one structure have been made. The London County Council Hall, by Ralph Knott, finished 1922, is impressive largely because of its size, but there is little attempt to express the double function. The best modern attempt at the inclusive building is the City Hall of Los Angeles, in which all the offices, council rooms, reception rooms, etc., are combined into one great building with a high office building tower, and a plan bearing certain resemblances to that of the Nebraska State Capitol.

Courthouses. The development of modern court practice, especially in America, has led to an almost standardized type of courthouse plan, in which large public corridors open on to the necessary courtrooms, each one carefully planned in relation to its judges' chambers, jury room, and so on. In general, classic styles have been preferred, until very recently, for the large scale of its various parts falls naturally into a classic membering. In the large city, the enormous number of courtrooms necessary has forced changes from the earlier simplicity of plan, and various attempts to combine efficiently monumental public entrances with ease of service and privacy have been

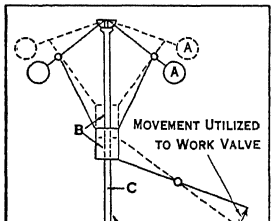
made. One of the most interesting plans to achieve this is that of the New York County Supreme Court Building, by Guy Lowell, in which a central rotunda surrounded by elevators leads to courtrooms on each side of its hexagonal plan. Central light courts give light and ventilation to the interior, and the corners are occupied with the smaller rooms. In their courtroom arrangements, modern courthouses abroad are quite similar, but one large, new element is almost universal in Europe, the *salle des pas perdus,* in which lawyers and their clients confer and where the lawyers meet each other. Good examples are the Palais de Justice at Paris, built over many periods, and the enormous, unconventional, and picturesque Palais de Justice at Brussels, by Polaert, 1866-83.

Administrative Buildings. In addition to the capitol proper, any national or state capitol requires extended office space for the various executive departments. Thus, in London, the national ministries are grouped along Whitehall in a series of great buildings of rather nondescript style, each built around its own court. In Washington, D.C., the national departments have become, unfortunately, scattered in buildings of every conceivable style; one of the great achievements of the new plan of Washington is their gradual relocation in a compact group and a harmonious style. In European cities, the ministries are frequently housed in altered noblemen's palaces.

A remarkable attempt to combine all the necessary buildings for a capital into one grand scheme is being made in the city of New Delhi, India, by Sir Edwin Lutyens and Sir Herbert Baker; the Viceroy's Palace, the Secretariats, and a vast circular building containing three legislative houses, together with various subsidiary buildings grouped around one great avenue have already been completed. A somewhat similar aim is being gradually achieved in the capital city of Australia, Canberra, by Walter Griffin. T. F. H.

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GOVERNORS, devices used in connection with prime movers or moving machinery to automatically keep speed within predetermined limits despite variations in the work they are called upon to do, or fluctuations in the working pressure supplied to them. The commonest form actuates the valve controlling the flow of steam, water or gasoline through linkages connected with weights that are displaced by centrifugal force. A typical governor is shown in the figure, where any displacement of the balls "A" results in a movement of the sleeve "B." As the speed of the spindle "C" increases, the centrifugal force acting on the balls displaces them to the position indicated in dotted lines. This raises the sleeve and the movement is utilized, through appropriate linkages, to close a valve. Many variations of this basic principle are possible. On elevators, any speed beyond that considered safe throws revolving weights outward, setting the brakes on the elevator guide, the electric power being simultaneously shut off from the motors. The "hit-and-miss" regulation of oil and gas engines is accomplished by shutting the gasoline throttle entirely when safe speed is exceeded, and opening it again when the engine has lost momentum. Some governors operate through hydraulic pressure (*see* POWER TRANSMISSION, HYDRAULIC) generated by displacement of the sleeve. M. Sc.



FLY-BALL GOVERNOR

As the speed increases, the balls and valve arm move into the dotted position, cutting off steam to restore normal speed

GOVERNOR'S ISLAND, an island situated in New York harbor, about ½ mi. south of the end of Manhattan Island. It is at the entrance to the East River, and is separated from Brooklyn by Buttermilk Channel. Governor's Island is used exclusively by the Federal government as a headquarters for the army officers of the Metropolitan district. Fort Jay and Castle William are located on the island. The greater portion of the island is reclaimed land.

GOWER, JOHN (c. 1330-1408), English poet, was a native of Kent. There is no precise information concerning his early life beyond the fact that he was a friend of GEOFFREY CHAUCER. His chief works are *Speculum Meditantis,* a poem of 30,000 lines written in French, *Vox Clamantis,* written in Latin, and *Confessio Amantis,* his best work, composed in English. These poems do not show any poetic genius, but Gower possessed the gift of narration. His will is dated Aug. 15, 1408, and his tomb may still be seen in St. Saviour's Church, Southwark, London. *See also* ENGLISH LITERATURE.

GOYA Y LUCIENTES, FRANCISCO (1746-1828), Spanish painter and engraver, was born at Fuendetodos, in Aragon, Mar. 30, 1746. By copying Velasquez he learned to give his paint the sense of life and his canvases run the gamut from the many exquisite portraits of women and children to the violent brutality of the massacre of *Dos de Mayo.* Goya designed cartoons for tapestries, executed religious murals, decorated the walls of his home with terrifying frescoes and etched impressions of the bullring. He was the first to use the recently invented lithographic medium for artistic purposes: the *Disasters of War* are trenchant anti-war propaganda, another series an attack upon the corruption of the Church. Goya's portraits are subtle and brilliant; the canvases of his royal patrons, the Spanish-Bourbons, are studies in degeneracy, but those of his wife and little grandson are interpreted with the utmost tenderness. Goya is best represented at the Prado Museum, Madrid. The Hispanic Museum, New York, has a portrait of the painter's mistress, the Andalusian Duchess of Alva, who also posed for the famous *Nude Maja;* and in the collection of Jules Bache, New York, is *Don Manuel Osorio,* the finest of the child portraits. Goya died at Bordeaux, Apr. 16, 1828.

GOZZI, CARLO, COUNT (1720-1806), Italian dramatist, was born at Venice, Dec. 13, 1720. Forced

to turn to writing for a living, he launched a vigorous attack upon the dramatic methods of CARLO GOLDONI. To show that the old *commedia del arte* was not yet moribund, he composed his well-known *Fiabi,* 1761. This and similar works were comic fairy-tales in the Venetian dialect and utilized the stock characters of the *Comedy of Masks.* Foreign versions, such as that of *Turandot,* have retained a place in the present-day theater. Gozzi died in obscurity, Apr. 4, 1806.

GRAAF, REGNIER DE (1641-73), Dutch physician and anatomist, was born at Schoonhoven, July 30, 1641. He studied at Leyden, Utrecht, and Lowen and in 1672 discovered the Graafian follicles of the ovary. His further studies advanced knowledge of the structure and function of the generative organs of both sexes. He died at Delft, August 17, 1673.

GRAB BUCKET. *See* EXCAVATING MACHINERY.

GRAÇA ARANHA, JOSE PEREIRA DE (1868-1931), Spanish-American author and diplomat. By culture as well as by training, Aranha was the cosmopolite. He served his nation at home and abroad. When the noted diplomat, Joaquim Nabuco, went to Italy to settle before the king the boundary dispute between Brazil and Great Britain in the matter of British Guiana, Graça Aranha accompanied him as secretary. He was Brazilian Minister at Christiania, and later Plenipotentiary for Brazil at The Hague. He was thus admirably suited to know not only the Latin component of his country, but also the Teuton. His native exuberance was tempered by a serenity derived from European influences.

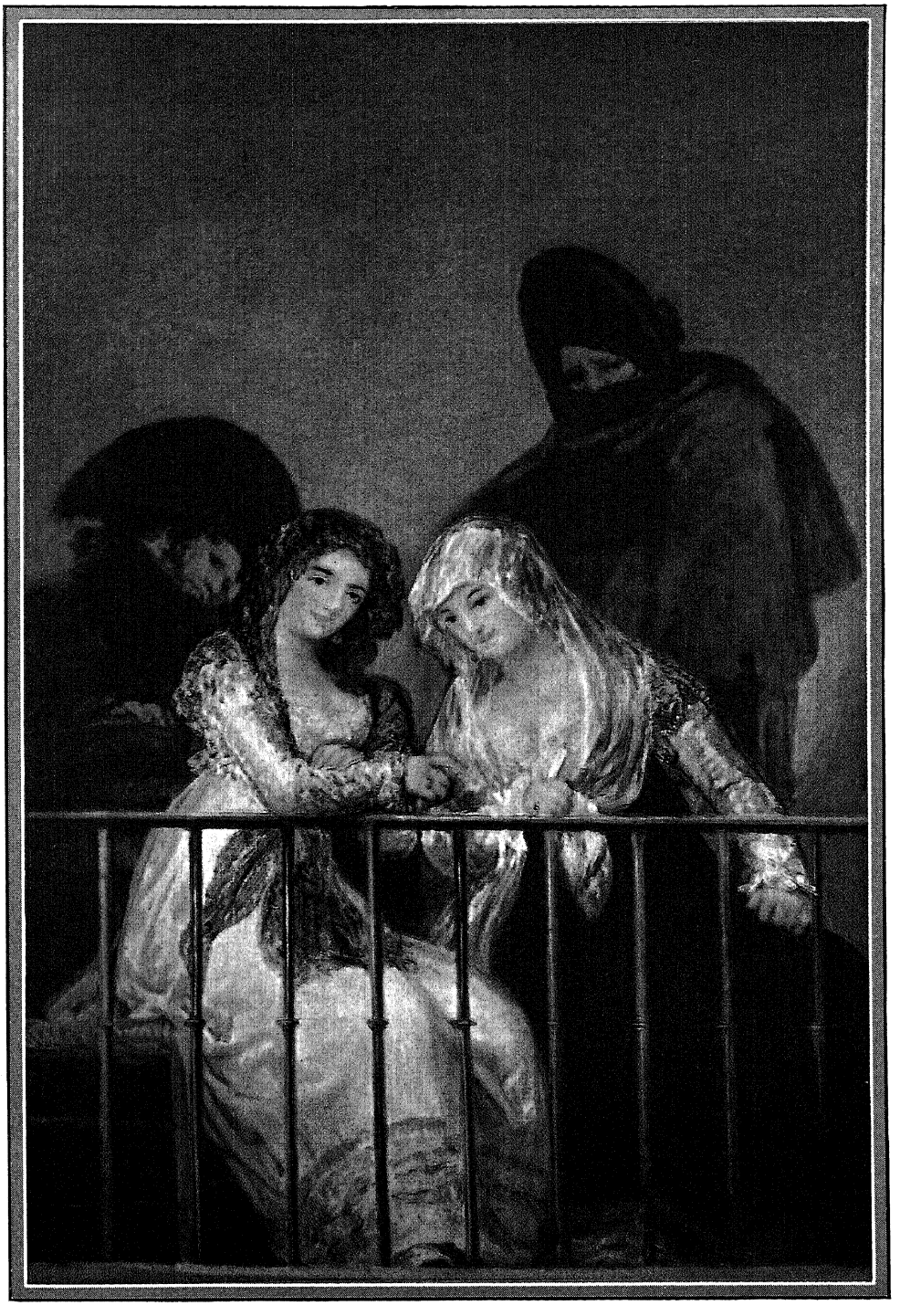
Graça Aranha is known almost solely for his novel, *Chanaan,* 1902, which stands alone in the history of Brazilian literature. Replete with philosophical implications, this work concerns itself not only with the Brazilian melting-pot, especially in its fusion of the German and the Latin strains, but with the ideological problems arising from such a New World amalgamation. In their enthusiasm over the non-literary values of the novel, native critics have been inclined to exaggerate its aesthetic importance. During the World War Aranha lost his philosophic calm and became violently anti-German. His cultural roots, after all, were in Paris, where he was the friend of Anatole France, Maurice Barrés and the contemporary aesthetes, and where *Chanaan* was hailed as "the great American novel," being known, together with Aranha's play, *Malazarte,* 1911, almost as well in its French version as in the original.

Aranha was the author also of *A Esthetica da Vida,* 1921, translated as *The Aesthetics of Life.* He inclined toward an Oriental Nirvanism, a vague and not too stinging pessimism that was not incompatible with a mystical pantheism. I. G.

GRACCHAN LAWS, statutes proposed by the GRACCHI, during their tribuneships: Tiberius, 133 B.C.; Gaius, 123-122 B.C. Tiberius, interested in restoring the position of the small farming class, observed the vast amount of recently conquered public land which was held in large estates, contrary to the LICINIAN LAWS. The consuls empowered to distribute such land on leasehold had favored the senatorial class, members of which kept it for generations, and almost regarded themselves as freehold owners. Tiberius therefore proposed, once more, a limitation of such holdings, and a Commission of Three to redistribute them. This legislation, proposed to the Council of the Plebs instead of the Senate, an action constitutional but contrary to tradition, was passed only by illegally removing one of the vetoing tribunes; and although Tiberius was shortly thereafter murdered, the Commission succeeded in distributing all the land by 129 B.C.

Gaius, tribune 10 years after Tiberius, was prompted in his legislation by violent opposition to the senatorial order, and called another order, the equestrian (knightly), into power by his establishment of a non-senatorial court to try cases of provincial maladministration, and by the new device of collecting Asiatic taxes through tax companies (publicans). He also annoyed the Senate by insisting that the provinces be assigned to the office, not to the man: i.e., before election. In behalf of the people, he proposed laws to distribute grain below cost, and to restrict the length of military service. His suggestion to grant the franchise liberally outside the city was unpopular and the only one of these proposals which failed to pass. After his violent death the party of the *populares,* which flourished till the end of the Republic, was formed to defend these laws against opposition. It must be concluded that they were apparently well-intended, but neither statesmanlike nor farseeing, and served to aggravate what was already a desperate situation in Roman internal affairs.

GRACCHI, THE, two brothers, Tiberius Gracchus (163-133 B.C.) and Gaius (153-121 B.C.), Roman popular leaders. I. Tiberius, the elder, distressed by the concentration of land in the hands of the wealthy and by the impoverishment of the mass of small farmers, as tribune, 133 B.C., proposed the reinforcement of earlier laws limiting the size of individual holdings. He suggested that the revenue from the kingdom of Pergamum, recently bequeathed to Rome by Attalus III, be used to assist the farmers who should undertake the cultivation of the new lots created out of the larger estates which he proposed to divide. Opposed by his colleague Octavius, he forced him to resign, a dangerous precedent. Tiberius sought immediate restitution as tribune for the following year, which was unconstitutional. But party feeling running high, a riot broke out in which he was killed. II. Gaius appears first at the age of twenty as a member of a commission appointed to carry out his brother's land bill. As tribune in 123 B.C. he displayed statesmanlike qualities, making proposals well calculated to secure the favor of all classes. He won the city populace by proposing the sale of grain to them at half the usual market price. To remedy overpopulation in the city and to offer opportunities of financial betterment to the needy he proposed the establishment of colonies in Italy and even on the site of Carthage. He advocated the sub-



"THE MAJAS ON THE BALCONY"

By Francisco José de Goya y Lucientes (1746-1828). In the Metropolitan Museum of Art.

stitution of knights for senators on the juries chosen to try ex-provincial governors charged with extortion in the provinces. As a further sop to this order of society he suggested that the collection of taxes in the provinces be entrusted to the knights, who might expect reasonable profit from this activity. Re-elected tribune for the following year Gaius proposed the extension of the Roman franchise to all Latin communities, and the grant of Latin privileges to all the Italian allies. This proposal was defeated because the Romans, jealous of their own privileges, were unwilling to share them with others. Gaius, like his brother, met a violent death in the course of a civil disturbance. G. M. H.

GRACCHUS. *See* GRACCHI.

GRACE, EUGENE GIFFORD (1876-), American manufacturer, was born at Goshen, N.J., Aug. 27, 1876. He studied electrical engineering at Lehigh University. His association with the Bethlehem Steel Corporation began in 1889 when he obtained a job as engineer in charge of an electric crane. He held important positions with the Juragua Iron Company, a Bethlehem subsidiary, and in 1913 became president. In 1917 he was made president of the enlarged Bethlehem Steel Corporation and of the Bethlehem Shipbuilding Corporation. He was in large measure responsible for the redoubled production of cannon, ammunition, armor-plates, and ships in the United States during the World War.

GRACE, WILLIAM JOSEPH (1882-), American educator and clergyman, was born at St. Louis, Mo., Feb. 23, 1882. He studied at St. Louis University and St. Stanislaus Seminary, and for five years taught classical languages. In 1917 he was ordained a Roman Catholic priest. From 1920-25 he was dean of the college of arts and sciences at Creighton University and from 1925-28, president. In the latter year Grace became dean of the college of liberal arts at Marquette University.

GRACELAND COLLEGE, a coeducational institution at Lamoni, Iowa, founded in 1895 with the aid of the Reorganized Church of Jesus Christ of Latter-Day Saints. Departments of Arts and Sciences, Agriculture, Education, Engineering, Home Economics and Music, in addition to Special and Preparatory departments are maintained. The library contains 13,426 volumes. In 1930 there were 268 students, and a faculty of 24, headed by Pres. George N. Briggs.

GRACE NOTE, in music, an ornamental note which once had a variety of forms but now is seldom found except as the MORDENT and *acciaccatura.*

GRACES, in Roman mythology, the three goddesses of grace and beauty, called *Gratiae.* They are identified with the Greek CHARITIES.

GRACKLE, the name given in North America to various large blackbirds. The purple grackle (*Quiscalus quiscula*), about a foot long with handsome black plumage glossed with purple, green, blue and bronze, breeds from Long Island to the Alleghenies southward to Georgia and Alabama. It associates in large flocks, frequenting lawns and grassy meadows and nesting in colonies, usually in coniferous trees. In a bulky nest of mud and grasses it lays 3 to 7 generally bluish spotted eggs. Although often causing damage in grain fields, it feeds largely upon injurious insects. The closely allied bronzed grackle (*Q. q. aeneus*) has less purple and more bronze reflections on its plumage but is scarcely distinguishable in the field and has very similar habits. It is found in central and eastern North America, chiefly between the Rockies and Alleghenies. The Florida grackle (*Q. q. aglaeus*) is locally abundant from South Carolina to Texas.

The boat-tailed grackle (*Cassidix mexicanus major*), about 16 in. long, occurs near the coast from Chesapeake Bay to Texas, while the great-tailed grackle (*M. m. mexicanus*), sometimes 18 in. long, is found from Texas southward.

The name grackle is sometimes applied to other blackbirds, as the Brewer's blackbird and the rusty blackbird. *See also* BLACKBIRD.

GRADING MACHINES, in road building, are chiefly used in maintaining EARTH ROADS. The "scraping grader" comprises an adjustable cutting blade suspended from a frame on wheels, and drawn by horses or a truck. The "elevating grader," a combined digging and loading machine mounted on four wheels, carries a plow to loosen the soil and throw it upon a traveling belt which delivers it directly upon the embankment, or into wagons. It is an effective machine for filling ditches, laying up earth embankments, or for grading roads, and works best in light loam. It cannot be used in coarse sand or gravel since the plow will not throw this material upon the belt.

Other types of grading machines are used for sorting materials. Mechanical grading is possible only when there is a difference in size, shape, weight or surface of the material. Screens or sieves are usually used when separation is to be made as to size, air blast and sieve when there is a difference in the weight, and felt or rubber covered belts of rollers, or brushes, when there is a difference in the surface. Magnetic and electrical methods are sometimes used for classifying metallic materials. *See also* ORE TREATMENT.

GRADUAL (Latin *graduale*), in the Catholic Church a hymn, usually verses from the Psalms, sung at Mass after the reading of the Epistle. The hymn is so called because the priest stands during the hymn on the steps (*gradus*) of the altar.

GRADUATE, one who successfully fulfills the requirements necessary for a degree or diploma conferred by a school or college. As a verb the term signifies the completing of certain educational requirements.

GRADUATE SCHOOLS, institutions of higher education open only to students who have completed a four-years college course. In the United States these schools are usually affiliated with a university, frequently as graduate departments rather than separate schools. There have been several universities which were founded as graduate institutions, such as

Johns Hopkins, 1876; Clark University, 1889; Catholic University of America, 1889, and American University, 1891, at Washington, D.C. Later they included undergraduate schools.

GRADUATION, in physics, a means of marking on an instrument a scale whereby the instrument can be used for making measurements. For instance, one may have a plain glass cylinder and use it for dipping up water, but if it has a scale marked along its length, it is said to be graduated, and can be used for measuring not only in terms of its total capacity but also in terms of fractions of its total capacity and in standard units.

Frequently, a distinction is made in the name of an instrument relative to whether it is graduated or not. Thus a SPECTROSCOPE is an instrument for just viewing the SPECTRUM, while a SPECTROMETER has a scale graduated on it and can be used in quantitative measurements. Thus, we have the names, MICROSCOPE and micrometer, ELECTROSCOPE and electrometer, galvanoscope and GALVANOMETER, all carrying this distinction.

GRAEAE or GRAIAE, in Greek mythology, three daughters of Phorcys and Ceto, called Phorcydes. Their names were Dino, Enyo and Pephredo. They were sisters and guardians of the GORGONS, and between them had only one eye and one tooth, which they took turns in using. PERSEUS stole both and would not return them until the Graeae told him how he could kill Medusa.

GRAECO-PERSIAN WAR (490-479 B.C.), a series of unsuccessful invasions waged by the Persians against the Greeks. The Persian invasion was really provoked by the Athenians because of the assistance rendered to the rebellious Ionians. The first expedition in the reign of Darius the Great was in the form of a sea attack upon Athens in 490 B.C. The Persians landed near Marathon in Attica and were decisively beaten by the Athenians. Darius died in 485 B.C. and was succeeded by his son Xerxes who made careful preparations for three years for a second invasion of Greece. He gathered a large fleet and an immense army and made various political alliances with the object of depriving Greece of all external support. Xerxes set sail in 480 B.C. and was universally successful in the opening encounters. The Greek fleet was dispersed at Artemisium, the heroic resistance at Thermopylae was of no avail, Athens fell into the hands of the Persians, and the Greeks were trapped at the Isthmus of Corinth and in the Bay of Salamis. Here, however, the fortunes of war turned and the Greeks succeeded in completely overwhelming the Persian fleet in the decisive Battle of Salamis, 480 B.C. In the following year the Greeks completed their task by defeating the Persians in the Battle of Plataea in Boeotia, thus freeing continental Greece from the danger of Persian conquest. In the same year the victory of the Greeks over the Persians at Mycale in Asia Minor foretold the liberation of both sides of the Aegean from Persian influence. *See also* GREECE, ANCIENT; PERSIA, ANCIENT.

GRAECO-TURKISH WAR, a brief conflict which began with the sultan's declaration of war on Apr. 17, 1897, and was concluded by armistice 31 days later. The indirect cause of the war, which was disastrous for Greece, was the conflict between the two nations over reforms in Crete, held by the Turks since 1645. After Turkish soldiers in Candia, the island capital, fired on Christians, on Feb. 4, 1897, Greece responded by dispatching two warships to the island. A Cretan war was averted by the European powers, but the Greek militarist party began noisome preparations for a frontier war. The sultan declared war, soon after gathering a force of about 58,000 troops, commanded by Edhem Pasha, on the frontier of Thessaly. Greek forces consisted of 45,000 men, commanded by Prince Constantine. The Turkish advance, begun Apr. 18, encountered little resistance until Edhem Pasha's left wing was checked by the Greeks near Mati on Apr. 21. Two days later the Turks were threatening both flanks of the Greeks, and the latter's strategic retreat south toward Larissa became a rout. The Turkish command entered Larissa on Apr. 27. After partial entrenchment at Domokos, the Greeks prepared to resist further Turkish advances south, but the Turks launched a strong attack on May 17, threatening the Greek line of retreat. The other theater of the war, in Epirus, in which 28,000 Turks were opposed by 15,000 Greeks, was likewise militarily fruitless for the Greeks. An armistice was signed May 20, following the intervention of the Russian tsar. A peace treaty was signed Sept. 20, 1897, by which Turkey obtained an indemnity of 4,000,000 Turkish pounds.

GRAETZ, HEINRICH (1817-91), Jewish historiographer, was born in Posen, Poland, in 1817. Though conservative in his religious views, he contended for freedom of thought, but was not inclined to fight for freedom of ritual practice. As an historian he manifested a skillful ability to piece together fragmentary sources of information. His vast knowledge and extraordinary critical mind were equaled by a power to portray events and personalities. No Jewish work of the 19th century enjoyed such a popularity as his history of the Jewish people. It is a work of genius which has gone through many editions and translations in many languages. As professor of history at the University of Breslau and at the rabbinical seminary there he attracted many students. His contributions to the study of the Bible indicate unmistakably his sympathetic leaning to the liberal biblical criticism of the day. Graetz died at Munich in 1891.

GRAF, ARTURO (1848-1913), Italian poet and critic, was born in 1848 in Athens, Greece, of an Italian mother and German father. He was made Professor of Literature at Turin in 1882. As a poet he is best known for his *Medusa, 1880,* and *Rime della Selva,* 1906. His verse is characterized by unrelenting melancholy, pessimism, and the resigned acceptance of scientific dicta. Graf died at Turin, May 29, 1913.

GRAFE, HEINRICH (1802-68), German educator, was born Mar. 3, 1802 at Buttstadt. He was professor at Jena for a time and then devoted himself to the improvement of teaching methods and the reforming of school organization in Cassel and Bremen. Grafe wrote *Archiv fur das Praktische Volsschulwesen, Allgemeine Padagogik* and *Die Deutsche Volksschule.* He died in Bremen July 22, 1868.

GRAFLY, CHARLES (1862-1929), American sculptor, was born at Philadelphia, Pa., Dec. 3, 1862. He studied at the Pennsylvania Academy of Fine Arts, under Eakine, and in Paris. His work comprises portraiture and fanciful creations and includes the figures of England and France, on the New York Customs House, the Gen. Reynolds Smith Memorial, Philadelphia, and the *Fountain of Man.* He died at Philadelphia, May 5, 1929.

GRAFTING, INARCHING and **BUDDING,** variations of graftage, the natural or artificial process whereby a part of one plant, called the scion, unites with and grows upon the roots of another plant called the stock.

In inarching, or grafting by approach, scion and stock are sliced equally with a sharp knife, the cut surfaces brought and kept in intimate contact until the union is complete when the upper part of the stock and the lower part of the scion are cut away. In grafting the scion is a twig severed from any desired variety, trimmed in various ways and fitted to the stock. In budding only a single bud is used.

The objects gained by graftage include propagating varieties of woody and some herbaceous plants which cannot be conveniently reproduced by other methods; saving, by bridge or repair grafting, trees that mice or other animals have girdled, the scions being inserted both above and below the wounds; developing branches or flowers or fruits where these are lacking on trees or shrubs; facilitating reproduction of flowers or fruit on male or female, dicœcious, plants by grafting-in scions of the lacking sex; making self-sterile varieties fertile by grafting-in branches of other varieties to pollinate the flowers; enhancing the vigor of defective trees or shrubs by the influx of fresh sap, modifying plant character in wood, foliage or fruit.

Graftage is chiefly used to propagate varieties of woody plants that do not come true from seeds and that cannot be conveniently or cheaply grown from cuttings. In some form it is employed with all named varieties of tree fruits, nuts and many ornamentals. It is therefore a necessary business process.

The essentials of all methods are that each scion have at least one sturdy bud; that stock and scion be brought and held in intimate contact until they unite; that no shoots be allowed to grow from the stock; and that air, by grafting wax or other material, be excluded from the cut surfaces to prevent drying.

M. G. K.

GRAFTON, a town including several other residential villages, suburbs of Worcester, situated in Worcester Co., central Massachusetts. The village of Grafton is 8 mi. southeast of Worcester and is served by two railroads, bus lines and an airport. The principal manufactures are textiles, emeries, shoes and thread. John Eliot gathered together a band of "praying Indians" on this site about 1652. Grafton was incorporated as a town in 1735. Pop. 1920, 6,887; 1930, 7,030.

GRAFTON, a town in northeastern North Dakota, the county seat of Walsh Co. It is situated 40 mi. northwest of Grand Forks and is served by the Great Northern and the Northern Pacific railroads. Crops are well diversified, the principal ones being sugar beets, potatoes and wheat. Livestock and poultry are also raised. The state institution for the feeble-minded is here. Pop. 1920, 2,512; 1930, 3,136.

GRAFTON, a city in northern West Virginia, the county seat of Taylor Co., situated on the Tygart Valley River, 17 mi. northeast of Clarksburg. Bus lines and the Baltimore and Ohio Railroad afford transportation. Grafton is in an important coal-mining and lumbering region. Glass, pottery and bricks are the chief manufactures. A national cemetery where 1,800 soldier dead are buried and a monument erected to the memory of Bailey Brown, the first soldier killed in the Civil War, are at Grafton. A short distance south, at Philippi, the first inland battle of the Civil War was fought (June 3, 1861). Grafton is in a beautiful mountainous region. It was founded in 1852, incorporated in 1864, and became a city in 1899. Pop. 1920, 8,517; 1930, 7,737.

GRAHAM, FRANK PORTER (1886-), American educator, was born at Fayetteville, N.C., Oct. 14, 1886. He was graduated from the University of North Carolina, 1909, took his A.M. degree from Columbia University in 1915, and studied in England and Paris. Except for brief interruptions to pursue graduate study and to serve in the World War, Graham was a member of the history faculty of the University of North Carolina from 1912 until 1930, when he was elected president of the university.

GRAHAM, THOMAS (1805-69), British chemist, was born at Glasgow, Dec. 20, 1805. He became professor of chemistry at University College, London, in 1837 and master of the Mint in 1855. Conducting private research, chiefly into problems of solutions and gas diffusion, he was the first to distinguish between crystalloid and colloid solutions and his study of the use of membranes between different solutions laid the basis of the knowledge of osmosis. He established mathematical ratios for the diffusion of gases and discovered the passage of gas through hot plates of metal. He died at London, Sept. 16, 1869.

GRAHAME, KENNETH (1859-1932), Scottish writer, was born in Edinburgh in 1859. He first attracted attention as a contributor to *The Scot's Observer.* Grahame's complete work comprises essays, satires and poetry, including *Pagan Papers,* 1893, *The Golden Age,* 1895, an autobiography of his boyhood, and a book of poems, *The Wind in the Willows,* 1908. Grahame died in Pangbourne, England, July 6, 1932.

GRAHAME-WHITE, CLAUDE (1879-), English aviator, was born at Southampton, Aug. 21,

1879. As an engineer he was originally interested in the motor-car from which he turned to aeronautics, learning to fly with Bleriot and Farman in France. A pioneer in this field, he won prizes and established a school of flying in France in 1909, in which year he set up at Pau a speed record in a plane of 70 miles per hour. During the World War he superintended the construction of airplanes for the British government. His books on aeronautics include *The Aeroplane, Past, Present and Future,* 1911, *The Aeroplane in War,* 1912, *Learning to Fly,* 1913, *Aircraft in the Great War,* 1915, *Airways, Their Organization, Equipment and Finance,* 1918, and *Flying, an Epitome and a Forecast,* 1930.

GRAHAM LAND. *See* ANTARCTICA.

GRAIAE. *See* GRAEAE.

GRAIN, a unit of weight. The troy pound (*see* TROY WEIGHT) contains 5,760 grains and the avoirdupois pound (*see* AVOIRDUPOIS WEIGHT) comprises 7,000 grains. In diamond weighing, the grain is equal to one-fourth of the CARAT or 0.7925 troy grains. The grain as a unit of weight is supposed to have originated from the weight of a grain of wheat, an ancient standard.

GRAIN, PRODUCTION AND TRADE. *See* OAT TRADE; WHEAT-PRODUCTION AND TRADE; RICE, WORLD TRADE IN.

GRAIN CLEANERS. Foreign material is usually removed from grain by a fanning machine using the combined action of oscillating sieves and an air blast. The disk separator is used extensively, however, in areas where cleaning involves the removal of weed seed. In this type of machine the separation is made by disks containing pockets or cells of different depths, which separate the seed according to size.

GRAINGER, PERCY ALDRIDGE (1882-), Australian pianist, was born at Brighton (Melbourne), July 8, 1882. His first instruction was received from his mother, followed by work under Pabst, Kwast, and Busoni. After making his London début at the age of 18 he toured extensively in England, Australia and Africa, and made his New York début in 1915. He has enjoyed wide popularity in the United States as a concert pianist, and composed more than 60 works for the piano, chorus and orchestra.

GRAIN WEEVIL (*Sitophilus granaria*), a small, brown beetle of the coleopterous family *Curculionidæ.* The adult beetle is about ⅛ in. long and has ridged wing covers, somewhat grown together, so that it cannot fly and a long snout extending downwards. The female weevil eats holes in the kernel of the grain and there deposits the small, white eggs. The larvæ hatch within a few days, and feed on the inside of the grain. When full-grown, they change to white pupæ and emerge as adult beetles, the life cycle taking from six to seven weeks. Like the rice weevil, which it closely resembles, the grain weevil probably was imported into the United States with shipments of grain. These two insects are most destructive to grain.

GRAM, a standard measure of weight in the METRIC SYSTEM, approximately equal to the weight of one cu. cm. of water at its maximum density. Originally, the gram was the unit of the metric measure of weight, but now the international prototype of the kilogram is taken as unity. One gram equals 15.4323564 grains.

GRAM, the Anglo-Indian name for various leguminous food plants closely allied to the common kidney or haricot bean (*Phaseolus vulgaris*), especially to the urd or black gram (*P. Mungo*) and to the mung or golden gram (*P. aureus*). The name is given also to the horse-gram (*Dolichos biflorus*), cultivated in India for feeding horses and cattle, and it is sometimes applied to the chick-pea or garbanzo (*Cicer arietinum*).

GRAMA-GRASS, the common name for an important genus (*Bouteloua*) of grasses. There are 38 species, chiefly North American, 18 of which are found in the United States, largely in the open grassland of the Southwest. They are mostly low perennials with crowded one-sided flowering spikes. Several, as the blue grama (*B. gracilis*), the black grama (*B. hirsuta*), and the side-oats grama (*B. curtipendula*) are valuable cattle-range grasses.

GRAMOPHONE. *See* PHONOGRAPH.

GRAMPIAN HILLS, a mountainous range in central Scotland which includes Ben Nevis, Ben Macdhui and Cairngorm, the highest peaks in the country. The hills stretch 150 mi. northeast to southwest and divide the highlands from the lowlands. They are steep and rugged in the north, but are gently sloping in the south, providing excellent pasturage. Valuable rock, including quartz, porphyry and granite, are found here.

GRAMPUS, a small, slate-gray, variously mottled whale (*Grampus griseus*) of the dolphin family; also called killer, although the true killer whales are now classified in the related genus *Orcinus.* Grampuses are met with in all northern oceans, as far south as the Mediterranean, California and New Jersey. They travel about in schools, and seem most numerous in the Pacific, where sailors distinguish by name several color-varieties, one of which has a wholly white head. Some North Pacific examples reach a length of 25 ft. but most grampuses are much smaller.

GRANADA, capital of the province of Granada and one of the most important cities of Nicaragua, situated about 35 mi. southeast of Managua and 120 mi. from Corinto, the seaport.

The city is situated on the shores of Lake Nicaragua. It still has an air of leisure, dignity and wealth, although its status as chief commercial city of the Atlantic route passed when the San Juan River no longer carried the great bulk of Nicaraguan trade. With the railway taking traffic in the other direction, all motive to clear the swampy delta of the river vanished. The principal trade now is in cattle and hides, cotton, sugar, cacao and coffee.

Granada, which was founded in the first quarter of the 16th century by Francisco de Cordoba, was sacked three times by the buccaneers penetrating in-

land from the Atlantic side on the San Juan and from the Pacific coast in 1685. The city was also captured and burnt by Walker and his filibusters in 1856, but has since been rebuilt. There are a university and a large number of churches. Est. pop. 1929, 25,000.

GRANADA, a province of southern Spain, once the center of the kingdom of Granada. It is bounded on the north by Cordova, Jaen, and Albacete, on the west by Malaga, on the south by the Mediterranean Sea, and on the east by Murcia and Almeria. Its area is 4,838 sq. mi. Its chief city is Granada, an old metropolis of the Moors identified by many scholars with the ancient *Iliberris,* which may have been founded by the Romans. Under Alahmar, founder of the dynasty of the Nasrides, the kingdom of Granada flourished until 1492, when the Spanish entered Granada, overthrowing the last stronghold of the Moors in Spain.

GRANADA, the capital city of the province of Granada in southern Spain. Formerly capital of the Moorish kingdom, it passed into the hands of the Christian monarchs, Ferdinand and Isabella, in 1492. Located at the foot of the Sierra Nevadas it commands an unrivaled view of the snow-capped range and of the fertile plain below. There are several distinct sections in Granada, of which the hill crowned by the famous Alhambra, a Moorish royal palace, and the Generalife Palace and gardens is the most important. The oldest section of the city, a part of the Albaicin hills now inhabited by the gypsies, has tortuous cobble-stoned streets; in the modern section of the city the streets are broad and well-paved. The second important building in Granada, after the Alhambra, is the cathedral, begun in 1529 and finished 1703. The interior was decorated largely by Alonzo Cano; the tombs of Ferdinand and Isabella in the Royal Chapel, and the collection of rare manuscripts in the library are most interesting and valuable.

There are numerous parish churches, a university with several faculties, a Jesuit theological seminary, several libraries and various charitable institutions located here.

Granada is not important industrially, although there is trade in the agricultural products of the valley, and the manufacture of lace for mantillas is carried on in the homes.

Under the Moors Granada became a center of wealth and culture and it is from a hall of the Alhambra that Queen Isabella is said to have sent Columbus forth to look for the passage to India. Est. pop. 1929, 109,001.

GRANADILLA (*Passiflora quadrangularis*), a strong, smooth, climbing shrub of the PASSION-FLOWER family native to tropical America, highly prized for its luscious fruit and planted also as an ornamental. The sharply four-angled stems bear entire roundish leaves, 6 to 8 in. long, and large fragrant flowers about 3 in. across, green outside, rose-colored within, with a white and purple center. The brownish-yellow oblong fruit, sometimes 10 in. in length, is covered with a brittle rind, within which are numerous small flattish seeds surrounded by a delicious pulp and a refreshing acid juice.

GRANARIES are buildings for storing grain. They vary from small portable bins of wood or steel to large batteries of circular reinforced concrete bins. The essential requirements are: protection against dampness, good ventilation and secure construction. Arrangement for saving labor in handling grain, rat and vermin protection and space for processing machinery are desirable. Bin bottoms are usually sloped so that grain can be drawn out by gravity. Grain is elevated to the top of large granaries and distributed by spouts or conveyors to the different bins. Storages for ear corn require generous ventilation and are usually built with slatted sides or are made of perforated masonry units.

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GRANBY, a city in Shefford Co., Quebec, Canada, picturesquely situated 47 mi. southeast of Montreal, on the Yamaska River and Canadian National Railway. There is trade in regional farm produce, and manufactures include rubber, silk, tobacco and cereals. A pleasant city, Granby has many churches, largely Catholic, two parks and an adjacent airport. Founded by the United Empire Loyalists in 1829, it was incorporated in 1916. Pop. 1921, 6,785; 1931, 10,587.

GRAND ALLIANCE, WAR OF THE, the conflict in Europe during 1689-97 between members of the League of Augsburg, consisting of the German Empire and non-German states, together with England, the Netherlands, Spain and Sweden, on one side, against Louis XIV of France. In 1689 the autocratic Louis ordered the devastation of the German Palatinate. Meanwhile the Grand Army of the Allies moved southward and forced the French to surrender at Mainz. The following year 45,000 French troops severely defeated 37,000 Allied soldiers at Fleurus, Belgium. The same year the French were victorious at Staffarda, in Piedmont, occupied Catalonia, and in the north took Mons in 1691, and Namur the next year. At sea the alliance consistently defeated the French and in 1692 Louis definitely gave up the idea of invading England. Besides the campaigns had exhausted his armies. After the victory of Neerwinden in 1693, Louis began to retrench and consolidate his gains. The war ended with the peace of Ryswick, 1697.

GRAND ARMY OF THE REPUBLIC, a patriotic society composed of soldiers and sailors who served in the Union Army during the Civil War. The idea originated in 1866 with Dr. F. B. Stephenson and the Rev. W. J. Rutledge who had been respectively the surgeon and chaplain of the 14th Illinois infantry. The purpose was to preserve and strengthen the fraternal feeling among war veterans, to perpetuate the memory of the dead, to give mutual assistance and aid, to promote true allegiance to the Constitution, and to encourage the spread of universal liberty, equal rights and justice to all men.

After the establishment of the first post at Decatur, Ill., the society grew rapidly until in 1890 it had 409,489 members. Thereafter the number declined each year due to deaths of members and in 1930 was reduced to 57,500. Encampments are held annually in different large cities.

The activities of the society have included establishing soldiers' homes and other philanthropies for members. In the first 50 years of its existence it exerted a powerful influence on national politics through being almost solidly Republican in membership.

GRAND CANAL, the artificial waterway connecting Peiping with Hangchow in Chekiang Province, China. It is the longest canal in existence, stretching approximately 1,000 mi., and has been and still is of great importance as a means of transport and communication. The first section, from the Huai to the Yangtze rivers, was built in 540 B.C.; the second, from the Yangtze to Hangchow, in 610 A.D.; and the third, from the Huai River to Peiping (then Peking), in 1320. In recent years various plans have been discussed for cleaning and repairing the canal so that it may again be used throughout its entire length.

GRAND CANYON NATIONAL PARK, containing the most spectacular example of erosion in the world, is situated in north central Arizona. This region was set aside by President Roosevelt in 1908 as a national monument and on Feb. 26, 1919 an area of 1,009 sq. mi., was given park status by act of Congress. The Grand Canyon is a stupendous creation of nature which defies comparison and description. It is unequalled in size, form, intensity of coloring and inexhaustible changefulness.

Scenic Features. The Colorado River, which has carved out this mighty gorge, flows through a series of canyons for a distance of about 500 mi. in the region known as the Colorado plateaus. These canyons are deep and their sides are sheer. That part known as the Grand Canyon follows a winding course extending from Grand Wash Cliffs near the Nevada line to the head of Marble Gorge near the northern boundary of Arizona. The Grand Canyon National Park embraces about 56 sq. mi. of the wildest and most beautiful portion through which the Colorado River winds its way for a distance of 105 mi.

The northern rim is over 1 mi. above the canyon floor and nearly 1,000 ft. higher than the southern rim. The entire region slopes southward across the canyon area. The visitor approaching the southern rim by train comes suddenly upon his first glimpse of the canyon in front of El Tovar Hotel in Grand Canyon Village. Far below, he sees what appears to be a tiny winding stream, in reality the powerful Colorado. And beyond, stretching away to the north rim, is the vast panorama of temples and pyramids whose colorings and shadings change from minute to minute. The extension of Grandeur and Maricopa Points limits the outlook from El Tovar, giving the visitor a gradual introduction to the wonders which will be thrust upon him from Desert View, Grand View, and other vantage points.

The view from the north rim is preferred by many who have visited both north and south sides of the canyon. Here the huge formations which constitute the background of the view from the south are immediately beneath the observer and the river is hidden from sight. The opposite rim appears as a huge streaked wall, and far beyond lie the San Francisco Peaks. In contrast to the desert country on the south rim, the north rim is heavily forested. The climate is delightfully cool in summer, but so cold and snowbound in winter that from about Oct. 15 to May 15 it is closed to visitors.

The boundaries of the park closely hug the rims. Beyond the eastern boundary lies the PAINTED DESERT. In the western extremity of the park is the Havasupai Indian reservation in the depths of the tributary Havasu Creek Canyon.

Exploration. Garcia Lopez de Cardenas, a member of Coronado's expedition, was sent out from Zuni in 1540 to find the fabulous river told of by the Hopi Indians and first reported the Grand Canyon to the civilized world. An adequate description of the canyon was first made in 1851 by the Sitgreaves Expedition.

Major John Wesley Powell, afterward director of the U.S. Geological Survey, was the first to navigate the entire length of the canyon and to attempt a thorough exploration of it. May 24, 1869 he set out from Green River City, Wyo., with nine men and four small boats. Four men deserted during the perilous journey but on Aug. 30, after three months of hardship and danger, Major Powell and "the faithful five" emerged safely from the lower end of the chasm. They had an amazing story to tell, which, however, did not authenticate the then currently believed rumors of vast underground passageways for the river, titanic whirlpools, and herculanean waterfalls whose roar carried to distant mountain tops. In recent years the entire length of the river has been navigated several times but it is always an extremely hazardous undertaking.

Geological Formation. The highly colored rocks which form the Grand Canyon are chiefly sandstone, limestone, and shale laid down during the Paleozoic Era. The overlaying Mezozoic and Tertiary strata, which may be seen in Zion and Bryce canyons and generally in the regions to the north, have completely disappeared due to erosive processes. Many of the strata were laid down at the bottom of the sea, some were semi-arid plains, and one is thought by many geologists to have been sand dunes. Remains of primitive shellfish, worm trails, seaweed molds, ancient fish, long extinct plants, and fossil tracks of small animals which were probably early forms of amphibia are found in these stratified rock formations. In the depths of the canyon rocks of the Algonkian and Achean systems are found.

Travel Routes and Facilities. The south boundary of the Grand Canyon National Park is reached di-

rectly from Williams, Ariz., on the main line of the Atchison, Topeka, and Santa Fé Railroad, by a branch line of the railroad or by motor bus. Bright Angel Point on the north rim is reached by regular auto stage service from Cedar City, Utah, on the Union Pacific system and from Marysvale, Utah, on the Denver and Rio Grande Western Railroad.

By automobile, the south rim is 61 mi. via government maintained road from the National Old Trails Highway at Williams, Ariz. Another interesting approach from the National Old Trails Highway is via the Navahopi road from Cameron, Ariz., an Indian trading post on the Painted Desert. There are several good roads leading to the north rim which, however, can be traversed only during the summer season because of heavy winter snows.

Auto roads within the park reach various points along the canyon rim. Saddle horses and guides are available for trips along the rim and down the trails into the canyon. A horseback trip from Yaki Point on the south rim to Bright Angel Point on the north rim can be made in two days. Travelers spend the night at Phantom Ranch near the Suspension Bridge at the bottom of the canyon.

Free public camping grounds are maintained near Grand Canyon Village and at Desert View on the south rim and at Bright Angel Point on the north. Housekeeping cottages are also available at moderate rentals. The Grand Canyon National Park is open the year round.

Educational Features. Yavapai Station, a museum at Yavapai Point on the South Rim, has been worked out with the greatest scientific care to give the visitors an understanding of the geological forces which produced the Grand Canyon. The parapet along the outer wall is equipped with telescopes which give closeups of the Colorado River, the top of Cedar Mountain and of various significant rock strata. Within the building are exhibits including specimens of rock, diagrams and other supplementary material which are numbered to correspond with the numbers on the telescopes on the parapet. Informal talks with lantern slides and motion pictures are an important part of the Station's educational activities. Along the trailsides throughout the park fossil footprints, rock formations and other points of particular interest have been marked with explanatory signs. Campfire lecture grounds where park visitors gather to hear talks by the ranger naturalists are located on both the north and south rims. The rangers also escort field trips on horseback and automobile caravans.

GRAND FALLS, a magnificent cataract on the Hamilton River in southern Labrador, situated about 250 mi. from the sea where the river has a fall of 760 ft. in less than 12 mi. In this distance the channel narrows as the stream proceeds and is obstructed by large boulders. At the lower end it dashes through a gorge about 50 yds. wide where the swirling mass of water is thrown into boiling waves at least 20 ft. high. Finally the pent-up stream plunges down a steep incline of 100 ft. and drops in a vertical sheet 200 ft. to the circular basin below. The great boom of its fall can be heard for 20 miles. The total height of the fall is 316 ft. and its width at the top is about 200 ft. The volume of water is estimated at 50,000 cu. ft. per second Owing to the dense column of spray rising nearly 1,000 ft. from the foot of the falls, it is impossible to get a clear photograph of it.

GRANDFATHER CLAUSES, constitutional restrictions adopted by southern states with intent to debar Negroes from the polls. Louisiana in 1898 excluded illiterates from the franchise, but with several classes of exceptions to allow white illiterates to vote. One of these excepted classes was of sons or grandsons of any person privileged to vote on Jan. 1, 1867. Alabama in 1901 adopted a constitution excluding illiterates, but excepting, among other classes, those who had served in the army or navy of the United States or the Confederacy in time of war, and their lawful descendants in every degree. North Carolina adopted similar restrictions in 1900, Maryland in 1901, Virginia in 1902. Grandfather clauses and like restrictions were necessarily elaborate subterfuges to evade the 15th Amendment, specifically denying to any state the right to exclude anyone from the franchise on account of race, color, or previous condition of servitude. However, the Supreme Court in 1915 (*Guinn and Beal vs. United States*) decided that the 15th Amendment was in fact violated, and that Grandfather clauses were unconstitutional.

GRAND FORKS, a city on the eastern boundary of North Dakota, the county seat of Grand Forks Co.; it is situated on the Red River, at the mouth of the Red Lake River. Two railroads, airplanes and bus and truck lines afford transportation. Grand Forks is a trade center for the "Bread Basket of the World," as this wheat-growing region is called. The city has flour mills, packing houses, dairy plants, also a State-operated terminal elevator and flour mills. The University of North Dakota is located just outside Grand Forks, and cooperates with the State Geological Survey, the State Public Health Laboratories and a Federal Meteorological Station. Grand Forks was founded about 1870 and incorporated in 1881. Pop. 1920, 14,010; 1930, 17,112.

GRAND HAVEN, a port city and county seat of Ottawa Co., southwestern Michigan, situated on Lake Michigan at the mouth of the Grand River, 30 mi. west of Grand Rapids. It is served by bus and truck lines and the Pere Marquette and Grand Trunk railroads, and has steamer connections with Chicago and Milwaukee. Car-ferry service is an important feature of the port. Located in a berry district, Grand Haven is a shipping point for fruit, as well as celery and grain. The city has many manufacturing establishments turning out chiefly leather products, pianos, printing machinery, plumbing fixtures and pneumatic tools. There are also ship repair yards and foundries. Grand Rapids is famous as a summer resort. The first settlement was made in 1834 and in 1867 Grand Haven was incorporated. Pop. 1920, 7,205; 1930, 8,345.

GRANDI, DINO (1895-), Italian statesman. Grandi was born near Bologna, Italy, and received his early education at the lyceum of Bologna. He had just entered the law school of the university when the war broke out. Grandi's war career was noteworthy; he became a captain in the Alpine infantry at the age of 22, earned three war crosses, and was decorated on the field of battle for bravery. After the war he returned to the study of law at Bologna, then a Socialist stronghold. To check the radical movement spreading in Italy, Grandi soon decided to throw in his lot with D'Annunzio, who was preparing then to descend upon Fiume.

Meanwhile, however, an anti-Communist organization was being formed by Benito Mussolini, editor of *Il Popolo d'Italia* at Milan. Impressed with Mussolini's doctrines, Grandi organized Fascist groups. At the same time he founded a Fascist paper, *L'Assalto,* at Bologna, and was made chief of the newly created Fascist district of Bologna. In 1921 he had become sufficiently prominent to be elected deputy from Bologna, but his election was invalidated because he was below the legal age limit of 30. Grandi therefore continued his newspaper work, winning fame also as an orator and a trusted disciple of Mussolini. He was made Chief-of-Staff for the march on Rome, and legal adviser to the ruling quadrumvirate. In the formation of the Mussolini government, Grandi was one of the two chief negotiators with King Victor Emmanuel. He later became under-secretary of Internal Affairs in the new government.

During this period the age requirement for deputies was reduced and Grandi embarked upon a parliamentary career in which he attained the vice-presidency of the Chamber. He was promoted in 1925 to the post of under-secretary of Foreign Affairs, and in this capacity traveled on official missions to European countries, Turkey and the United States. He came to the United States in 1926 as a member of the Italian debt-funding commission, and in 1931 for conversations with President Hoover on the problem of international debts.

In 1929 the former lawyer and journalist was appointed Minister of Foreign Affairs. Grandi unquestionably reflects Mussolini's policies, but without his leader's truculence. He was Italy's representative at the London Naval Conference of 1930, and in the following year proposed the first widespread armament holiday ever agreed to. In July, 1932, Grandi was appointed Italian Ambassador to Great Britain.

GRAND ISLAND, a city in southern central Nebraska, the county seat of Hall Co., situated on the Platte and Wood rivers, 150 mi. southwest of Omaha. Bus lines and three railroads serve the city. There is a municipal airport, also two flying schools. Grand Island is approximately in the center of the United States, and the Government has established a radio Monitor station here. The surrounding country is a rich agricultural region, producing chiefly sugar beets and grain. The city is an internationally known horse and mule market, and has beet-sugar factories, stockyards, railroad shops and various other industrial plants. In 1929 the manufactures amounted approximately to $5,000,000; the retail trade was valued at $15,204,592. The city was settled in 1857; incorporated in 1873. In the early days large herds of buffaloes ranged these regions. Stolley State Park is situated near by. Pop. 1920, 13,947; 1930, 18,041.

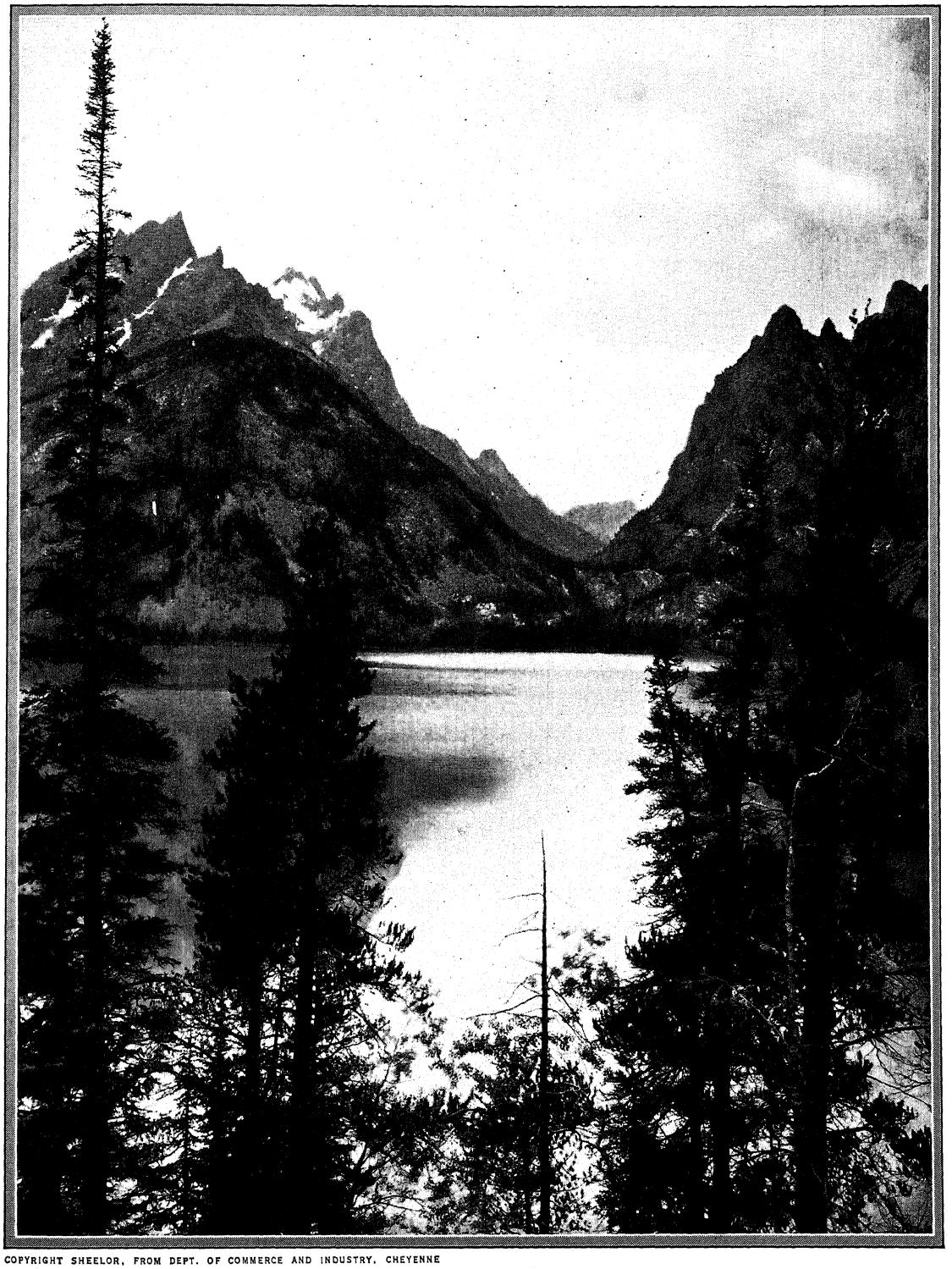
GRAND ISLAND PARK, a state park located on Grand Island in the Niagara River above Niagara Falls, near Buffalo, in western New York. The park was established in 1927 and comprises an area of 400 acres devoted to outdoor recreation. It is reached by ferry from the mainland.

GRAND JUNCTION, a city of western Colorado, the county seat of Mesa Co., situated at the junction of the Colorado and Gunnison rivers, about midway between Denver and Salt Lake City. It is served by the Denver and Rio Grande Western Railroad. Grand Junction lies in the fertile, irrigated Grand River Valley, a region producing fruit, grain, and live stock. The city has a sugar factory, a canning factory, flour mills and machine shops, and produces also coal, brick and clay products. The retail trade in 1929 amounted to $9,265,962. Unaweep Canyon, National Monument Canyon, Grand Mesa and other noted scenic beauties are near by. Pop. 1920, 8,665; 1930, 10,247.

GRAND JURY, at common law, a body of men summoned and returned by the sheriff to hear complaints and accusations in criminal cases and determine whether or not there is probable cause for prosecution. At common law it consisted of not less than twelve nor more than twenty-three. The mode of selection and number of Grand Jurors is governed generally by statute and varies in different states. Prosecution of infamous crimes solely by indictment or presentment by a Grand Jury was once required almost universally by American constitutions. But in the last century a general system of prosecution by information by the public prosecutor was adopted in California and nineteen states have now wholly done away with the absolute requirement of a Grand Jury. Others have done away with it in part. It is generally felt to-day that the Grand Jury system is expensive both in time and money, and in its demands upon citizens, that it affords needless opportunities for escape of offenders, and that it is not needed as a protection to the citizen against ill-founded prosecutions. Those who have studied the subject in recent years generally concur in recommending its abolition. *See also* JURY.

GRAND MANAN ISLAND, an island at the entrance of the Bay of Fundy, belonging to New Brunswick, Canada. It is 22 mi. long and 3 to 6 mi. wide, with a level, wooded surface. On its east coast there are several good harbors which make it important to the fishing interests of the province, and because of its agreeable climate it is a favored summer resort.

GRAND'MÈRE, an industrial city of Laviolette Co., Quebec, Canada, situated on the St. Maurice River and the Canadian Pacific and Canadian National



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ALONG THE TETON RANGE

Saddle of the Tetons in Grand Teton National Park, 150 acres of Wyoming mountains and lakes.

railroads, about 83 mi. southwest of Quebec. Hydro-electric power supplied by the Shawinigan Falls development is at the demand of the local factories making pulp, paper, shirts and shoes. A pleasant town, well-equipped with parks and educational foundations, Grand'mère is largely of French-Canadian population. It was incorporated in 1902. Pop. 1921, 7,631; 1931, 6,399.

GRANDMONTINES, or **BONI HOMINES,** monks of the austere eremitical Order of Grandmont, founded about 1100 by St. Stephen of Muret, near Limoges, France, and after his death transferred to the desert of Grandmont. The order flourished greatly in the 12th century, numbering 60 monasteries in 1170, but relaxations of observance led to bitter dissensions and, in spite of various attempts at reform, a decline set in which terminated in the dissolution of the mother-house in 1787.

GRAND OLD PARTY (G.O.P.), a nickname of the REPUBLICAN PARTY in the United States. The phrase, with its connotation of the venerable service of the Republican party in its successful prosecution of the Civil War and later in its protection of the interests of the nation, was largely used for sentimental effect during the presidential campaign of 1896. The initials G.O.P. are often used in humorous allusion to the party.

GRAND RAPIDS, a city and county seat of Kent Co., southwestern Michigan, situated on the Grand River, 152 mi. northwest of Detroit. Bus and truck lines, airplanes and five railroads afford transportation. The city is chiefly known as a furniture manufacturing center, although it has numerous other important manufactures, such as automobile bodies and accessories, knit underwear, carpet sweepers, paper boxes, canned goods and machinery. The factory output for 1929 amounted to $156,653,826. The wholesale trade proper, 1929, was worth $71,958,376. The region is rich in natural resources, having natural gas and oil wells and gypsum deposits. Dairying, fruit raising and truck farming are the principal occupations in the surrounding districts. In 1822 an attempt was made to establish a Baptist mission, on the present site of Grand Rapids, but hostility of the Indians thwarted the project until 1827. In the same year Louis Campau, who is considered the founder of Grand Rapids, established a trading post. The city was incorporated in 1850. Pop. 1920, 137,634; 1930, 168,592.

GRAND TETON NATIONAL PARK, a tract of 150 acres containing the most spectacular part of the Grand Teton Mountain group, was established by act of Congress approved by President Coolidge on February 26, 1929. It is located in northwestern Wyoming, about 11 mi. south of the southern boundary of YELLOWSTONE NATIONAL PARK.

These bare and tooth-like mountains, one of the most tremendous ranges in the world, rise abruptly from the comparatively flat floor of Jackson Hole, the complete absence of transitional foothills greatly enhancing their height and majesty. Grand Teton, the principal peak, elevation 13,747 ft., bears a striking resemblance to the Matterhorn of the Alps when viewed from the east and south. The mountains are snow-capped and small glaciers still linger in the upper recesses. Five beautiful lakes, two of them accessible by automobile, nestle at the foot of the mountains.

The park is reached on excellent U. S. Interstate Highways. Victor, just across the state line in Idaho on the Oregon Short Line, is the nearest railroad connection.

GRANGER CASES (1877), in United States constitutional history, a group of cases arising from grange-sponsored legislation in middle western states. The legislation whose validity was questioned fixed maximum rates for railroads and for grain elevators. The principal case, *Munn vs. Illinois,* involved a statute fixing maximum charges on storage of grain in all elevators and public warehouses. Counsel for the elevators pleaded violation of the 14th Amendment, a deprivation of property without due process of law. Chief Justice Waite, rendering decision on Mar. 1, 1877, stated that when property has become clothed with a public interest, the owner must submit to be controlled by the public for the common good; and that the grain elevator business, practically a monopoly in the Middle West, possessed such an interest. In the case of *Peik vs. Chicago and North-Western Railway* the decision was that a provision in the company's charter authorizing the railway to charge such rates "as it may deem reasonable" did not alter the fact that charters are subject to reservations contained in the general laws under which corporations were created, or in the state constitutions. In other cases the Court upheld statutes fixing maximum rates for railroads, stating that the state police power was supreme in the regulation of public corporations. In 1886, however, the Court ruled (*Wabash, St. Louis and Pacific Railway vs. Illinois*) that no state can exercise any control over commerce which passes beyond its borders. This decision became the established precedent, and, by putting an end to attempts of state governments to regulate interstate commerce, gave impetus to the creation of the Interstate Commerce Commission.

GRANGERS, members of local or subordinate granges of the National Grange of Patrons of Husbandry. This order, a national farmers' fraternity, is secret, admitting to membership farmers, their wives, and farm youth of 14 years of age or older.

The qualifications for membership in the Grange are: a real interest in the progress of farming and the farming industry; fraternal regard for farmers; a sober, industrious cooperative worker; a public spirited member of the order; and an exemplar of the Golden Rule. The purpose of the grange is to develop a true brotherhood among farmers, and to strongly unite with their families for the welfare of the agricultural and rural life of America.

The order was organized in 1867. In the period of 1870 to 1875 it seemed destined to help the farming industry out of its acute depression. By 1880 most

of the members had dropped from active membership but a faithful nucleus membership persisted and grew. Now no political or social, regional or national question touching farmers and the farming industry, is considered adequately canvassed until the position of the grange is ascertained. The grange can fairly claim a large share in educating farmers to class consciousness regarding economic and social fundamentals.

Thirty-three States of the Union were organized in 1931, having a dues-paying membership of over 800,000. The order has many grange halls of its own, as well as many cooperative, purchasing and selling stores. O. S. M.

GRANITE, one of the common and important IGNEOUS ROCKS, made up largely of one or more of the FELDSPARS orthoclase, microcline and albite, with QUARTZ, and usually minor amounts of MICA, HORNBLENDE or, rarely, PYROXENE. The light-colored minerals are in excess, feldspar predominating, so the rock is normally white, gray or pinkish. When some particular mineral is prominent, a special name may be given, as hornblende granite or MUSCOVITE granite. The granites are plutonic rocks, having cooled from a molten mass at great depths beneath the surface. Consequently the minerals are well crystallized. When especially large crystals form, usually with some rarer minerals, the name PEGMATITE is applied. A molten mass, or MAGMA, of the same composition when extruded or ejected at the surface as a LAVA, cools so rapidly that the crystals have no time to form, and the resulting cryptocrystalline rock is called RHYOLITE. It is not unusual to find granitic rocks in which large crystals of one or two minerals are contained in a fine-grained ground mass. This is known as porphyritic texture, and in this event the rock is called a granite PORPHYRY or rhyolite porphyry, depending on the fineness of the ground mass.

The percentage of water absorbed by the granites is small, and their crushing strength high, making them suitable for building stone. The coarser and medium grained rocks are well adapted to massive construction work, while those of finer grain and beautiful color, which take a high polish, are suitable to monumental work.

Granites are widely distributed throughout the world. In the United States, the Appalachian belt and the States of Wisconsin and California are the main producers. *See also* ARKOSE; PETROLOGY.

GRANITE BLOCK PAVEMENTS have a wearing surface of granite blocks 4 in. to 6 in. wide, 6 in. to 16 in. long and 4 in. to 5 in. deep. The surfaces are "true" to ¼ in., and they are set in a cushion of sand or stone screenings. The joints are filled with cement grout or with a "mastic" of sand and asphalt. Such pavements have satisfactory "riding" qualities and when laid on good PAVEMENT BASES, need very little maintenance. They are the commonest heavy-traffic pavement of the modern city, expensive but long lived. A variant of this type involves the use of small granite cubes laid in interwoven arcs.

GRANITE CITY, a city of Madison Co., southwestern Illinois, situated near the Mississippi River, about 8 mi. north of East St. Louis. It is served by the Big Four, the Wabash, the Alton and the Nickel Plate railroads. Car and steel foundries, metal works, a rolling mill and a syrup plant make up the chief local industrial interests. In 1929 the total manufactures amounted approximately to $58,000,000; the retail trade was valued at $11,677,867. Cahokia Mounds State Park lies 5 mi. south. Granite City was settled in 1893 and incorporated in 1896. Pop. 1920, 14,757; 1930, 25,130.

GRAN QUIVIRA, a national monument, created Nov. 1, 1909, and enlarged to its present size of 423.77 acres in 1919, situated in central New Mexico. It includes the ruins of Gran Quivira, a Spanish church built about 1620 and of a "new" church built about 1649 as well as important Indian Pueblo ruins. The walls of the "new" church are 40 ft. high in places and indicate a floor space of 4,978 ft. Remains of an extensive monastery and convents can be plainly seen. These ruins are easily reached by automobile from Mountainair, N.M., a town about 25 mi. northwest on a U.S. Interstate Highway and the Santa Fe railroad.

GRANT, SIR ALEXANDER (1826-84), English educator, was born in New York, Sept. 13, 1826. He was educated at Harrow and Oxford and specialized in Aristotelian philosophy. In 1857 he published an edition of the *Ethics* which became a standard textbook at Oxford. After 1868 he served as principal of Edinburgh University and was instrumental in establishing a medical school there. Grant died at Edinburgh, Nov. 30, 1884.

GRANT, ULYSSES SIMPSON (1822-85), eighteenth President of the United States, was born Apr. 27, 1822, at Point Pleasant, a small village on the Ohio River, 45 mi. east of Cincinnati. Shortly after the boy's birth, his father, a tanner, moved his



GRANT'S BIRTHPLACE, POINT PLEASANT, OHIO

family to Georgetown, O., where, in addition to his tannery, he acquired some farm land. In working the farm young Grant acquired his capacity for unremitting hard work. His early schooling, in that sparsely settled region, was somewhat haphazard.

When Ulysses was 16 his father, through the Congressman of his district, obtained for him an appointment to the U.S. Military Academy at West Point. Although the appointment came as an unwelcome surprise to the boy, he was entered as a student in the class of 1843. Through an error his given name, Hiram Ulysses, was written in the official nomination as Ulysses Simpson. This error accounts for his cadet nickname, "Uncle Sam," and the Press name, "Unconditional Surrender" Grant. At the Military Academy he showed talent for drawing and mathematics, and graduated 21st in a class of 39. Commissioned as a Brevet 2nd Lieutenant upon graduation, he was assigned to the 4th U.S. Infantry, which he joined at Jefferson Barracks, near St. Louis, in the Fall of 1843. During the year spent there he became engaged to Julia Dent, the daughter of a nearby planter.

In the summer of 1844 the 4th Infantry was ordered to the South, and a year later, upon the annexation of Texas, was ordered to join the Army of Occupation under Gen. Zachary Taylor. In 1846 hostilities with Mexico began with the border fights of Palo Alto and Resaca de la Palma, in the second of which Grant commanded his company in action. In the advance across the border he acted as Regimental Quartermaster, a responsible post which he filled with credit. After the battle of Monterey the 4th Infantry was ordered by sea to Vera Cruz to join the column of General Scott. Grant distinguished himself in the battles during the march to the City of Mexico, and was twice cited for a brevet promotion for gallantry.

Returning to the United States after the Mexican War, Grant in 1848 was married to Miss Dent, and the young couple began life together at Sackett's Harbor, Mich. In 1852 the 4th Infantry was ordered by way of Panama to the Pacific Coast. His young wife could not accompany him there, and after two years of separation and unhappiness Grant, then a captain at Vancouver Barracks, resigned his army commission and returned east to begin life anew. He had little success. He first tried farming. Next he tried real estate and collections, but proved unable either to sell or to collect. Finally, he appealed to his father for help, and accepted the suggestion that he become a clerk in the leather store conducted by his two younger brothers in Galena, Ill. In that obscure position the outbreak of the Civil War found the man destined to rise within two years from obscurity to military fame.

After the fall of Ft. Sumter Grant's immediate impulse was to make his military experience of use to his country. He drilled a volunteer company raised in Galena, accompanied them to Springfield, Ill., and offered his services to the governor of Illinois. He was asked to assist in the preparation of muster rolls and other army papers unfamiliar to the state officials. Two months later Governor Yates, having a mutinous regiment on his hands, made Grant its colonel. In August, the Congressman of Grant's district, likewise recognizing his ability, secured from President Lincoln Grant's advancement to the rank of brigadier general. Gen. Fremont, commander of the Western Department, chose him to command at Cairo, the vital point in the West, during the crisis in Sept. 1861, when Confederate troops first invaded Kentucky. Grant proved from the outset that he possessed rare qualities as a leader, an unrelenting sense of duty, tireless energy and the ability to discover the enemy's weaknesses and to take advantage of them. Although he originally lacked technique, he was able, by commanding gradually increasing numbers, to master the necessary lessons step by step. At Belmont in 1861 he commanded a small division; at Forts Henry and Donelson in 1862, three divisions; at Shiloh in 1862, six divisions; at Vicksburg in 1863, three army corps.

However, Grant's military career was not an even march to success. The press blamed him for bungling at Belmont, praised him to the skies for capturing 16,000 Confederates at Fort Donelson, but again savagely excoriated him for his losses and the narrowness of his victory at Shiloh. Nor were his immediate superiors more appreciative. After Donelson, his chief, Gen. Halleck, accused him of sitting down "to enjoy his victory," and threatened him with arrest. Halleck for a time virtually removed him from command, and kept him for five months after the battle of Shiloh in a position as uncomfortable as the position in his brothers' store in Galena.

Finally restored to command in Sept. 1862, he came for the first time under the direct orders of President Lincoln, who thenceforth steadfastly supported him despite the attacks of the press. On July 14, 1863, the capitulation of 30,000 prisoners at Vicksburg partially silenced his critics.

While Grant's success at Vicksburg had been the outstanding achievement of 1863, two other commanders of main Union armies had also met with success, Meade at Gettysburg and Rosecrans in Tennessee. In September, however, Rosecrans, beaten at Chickamauga, found his army bottled up in Chattanooga, facing starvation. The President solved this problem by enlarging Grant's command to include, in addition to the Mississippi Valley, the entire state of Tennessee. Grant's presence at Chattanooga soon turned the scales in favor of the Union. Congress then revived for Grant the military rank of lieutenant-general, and the President called him to command all the armies of the Union.

In the Wilderness-Petersburg Campaign of 1864 and 1865 Grant actually accompanied the Army of the Potomac, commanded by General Meade, leaving his trusted subordinate, Gen. Sherman, to command in the West. But, though compelled at times to interfere in the conduct of Meade's army, Grant's chief rôle thereafter became that of coordinator and strategist. The final surrender of Lee's army at Appomattox on Apr. 9, 1865, was soon followed by the surrender of Johnston's army to Sherman and the total collapse of the Confederacy.

During the years of reconstruction Grant, who had little aptitude for politics, gradually drifted into a critical attitude toward President Johnson, which encouraged the Radical Republicans to groom him for the presidential nomination in 1868. His personal popularity in the northern states made him a strong candidate and he was enthusiastically nominated by the Republican Convention. He defeated Horatio Seymour in the election of 1868 and was re-elected by an even larger plurality in 1872, when his opponent was Horace Greeley.

Certain historical writers have tried to picture Grant's two administrations as periods of the high-water mark of governmental corruption and to lay at Grant's door the horrors of the reconstruction period. No serious critic, however, has ever ventured to impugn his entire honesty of purpose. His administrative actions which have been deemed the most objectionable were the natural result of his military outlook. Thus, Grant's conception of the President's Cabinet was that of a military staff to be assigned and shifted to meet momentary requirements, rather than the statesman's ideal of a responsible body of strong departmental chiefs whose tenure of office should be as fixed as that of the President himself.

Despite his limitations, and the recurrent scandals of his administration, the great commander won high praise for certain aspects of his presidential policies. In a most exasperating period of United States history his prestige aided in quieting disputes in domestic and foreign affairs. The diplomatic skill of Hamilton Fish, his Secretary of State, effected an honorable settlement of war claims against England, and established the principle of international arbitration of such claims. A dispute with Spain over Cuba was handled with a tact that brought a peaceful solution.

In domestic affairs Grant's veto of the Inflation Bill marked the end of the Civil War inflation period and led to the adherence of the United States to the principles of sound finance. Advised by Hamilton Fish, Grant was the first President to urge upon Congress the necessary legislation on Civil Service Reform, even though his own administration proved a disappointment to those who had looked for the immediate disappearance of the spoils system.

At the conclusion of his second term Grant started upon a world tour. Upon his return the leaders of the stalwart faction in the Republican Party persuaded him to become a candidate for the Republican nomination in 1880. His supporters, ably led by Roscoe Conkling, waged a determined fight in the Convention, but encountered such opposition from the reformers that they failed to secure the prize. Sorely in need of funds, and unacquainted with the ways of the business world, Grant unwittingly sold his name as partner to a Wall Street shyster, who paid him in pretended dividends until the bubble burst in May, 1884. Grant was soon cleared in the public mind of either wrongdoing or dishonest intentions, but he insisted on giving up to his creditors everything down to his last war trophy.

Though broken in health by the shock of this experience, he turned, as the sole means of providing for his family, to the composition of his immortal *Memoirs*. It was not until a few months before his death at Mount McGregor, N.Y., on July 23, 1885, that public sentiment, as a last tribute to a great commander, granted the restoration of his pay and rank as General of the Armies of the United States.

A. L. C.

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GRANTHAM, a town in Lincolnshire, eastern England; Lincoln lies 25 mi. to the northeast. The town is built on the left side of the Witham River, and has become a railroad and transportation center, connected by canal with the River Trent near Nottingham. A grammar school established in 1528 by Bishop Fox was attended by Sir Isaac Newton from 1655 to 1656. The chief industries of the town are the manufacture of agricultural tools, brick-making and malting. The most celebrated edifice is St. Walfram's Church which has a spire towering to a height of 278 ft. Pop. 1921, 19,630; 1931, 19,709.

GRANT MONUMENT, an equestrian statue of Gen. Ulysses S. Grant on North Shore Drive, Lincoln Park, Chicago. It was executed in bronze by Louis T. Rebisso and unveiled Oct. 7, 1897. This memorial is 18 ft. high and represents the General in full uniform holding a field glass in his right hand. His expression of critical inspection suggests that he is reviewing a movement of troops.

GRANT'S TOMB, the mausoleum of Gen. U. S. Grant on Claremont Heights, near West 122nd St., New York City. It was designed by J. H. Duncan and completed in 1897 at a cost of $600,000, given in large part by citizens of New York. The tomb, 150 ft. high, is built of solid blocks of white granite. The lower story, 90 ft. sq., is built in the Doric style and above is a circular cupola, 70 ft. in diameter, supported by Ionic columns. Designed after Napoleon's tomb at the Hôtel des Invalides, the interior is lined with white marble. Gen. and Mrs. Grant are buried side by side in the center of the crypt beneath the dome. Each sarcophagus is cut from a single slab of red granite. The life of General Grant in alto-relief by J. Massey Rhind decorates the pendentives of the dome. A collection of flags belonging to Civil War regiments fills two small rooms.

GRANVILLE-BARKER, HARLEY (1877-), English actor, manager and playwright, was born at London Nov. 25, 1877. He acted with Ben Greet and Mrs. Patrick Campbell, produced plays by G. B. Shaw for the Stage Society and in 1904 assumed the management of the Court Theatre, London. In 1910 he gave up acting to devote himself to writing plays. His dramatic works include *Prunella* (with Laurence Housman), *The Voysey Inheritance, The Madras House, The Marrying of Ann Leete* and *Waste;* with

Helen Granville-Barker, his wife, he has made a number of translations from the Spanish, the plays of G. Martinez Sierra and of Joaquin and Serafin Alvarez Quintero. Granville-Barker's prose works include *A National Theatre,* 1907, in collaboration with WILLIAM ARCHER, *The Exemplary Theatre,* 1922, and *The Eighteen-Seventies,* 1929.

GRAPE, a name used in the United States and Canada for either the plant or the fruit of any species of *Vitis,* the typical genus of the vine family. In other English-speaking countries only the fruit is called the grape, the plant being known as the vine. The grape is a woody, deciduous shrub which climbs by means of coiling tendrils that also become woody. The stems grow rapidly, on cultivated vines often 20 ft. in a season. In late spring clusters of small greenish fragrant flowers appear and are followed by purple, red, greenish or black fruit.

The Old World grape (*V. vinifera*), probably a native of southwestern Asia, adjacent Africa and Europe, is one of the first fruits to be domesticated. Its record antedates biblical times as the producer of both raisins and wine, but its dessert and culinary uses were and still are of minor importance in the Eastern hemisphere. Repeated attempts to grow the grape in America from early colonial days until the latter part of the 19th century invariably failed. The causes were a destructive species of aphis (*Phylloxera*) and brown rot. The Old World grape has found its commercial American home on the Pacific coast, especially in California, where it is extensively grown.

Although only one species has given rise to all the Old World varieties, America lists more than 20 species, which cover the continent from and including Canada to the tropics. Notwithstanding this wealth of species, the cultivation of American grapes attracted practically no attention until about the beginning of the 19th century. Two varieties, the Delaware and the Catawba, introduced about that time are still grown because of their merit. However, American grape culture of indigenous varieties and hybrids with European kinds did not become important in home gardening until after the introduction in 1849 of the Concord, a pure American variety of the northern fox grape (*V. Labrusca*). Although the Concord is distinctly inferior in quality to many other varieties since introduced, it has become the leading commercial grape in the northeastern United States and adjacent Canada. This species (*Labrusca*) has attracted more attention than any other, yet it seems less deserving than some of the southwestern species, especially the summer, bunch or pigeon grape (*V. æstivalis*) and the post oak, pinewood or turkey grape (*V. Linsecomii*), which have each developed several excellent varieties. The most important species of the Southeast is the muscadine grape (*V. rotundifolia*), parent of the famous Scuppernong. In addition there are several kinds which are still more promising, but which have attracted little attention from originators of varieties.

Commercial growing of American varieties has developed largely in the Hudson Valley and the finger lakes section of New York, the shores of Lakes Ontario and Erie, the eastern shore of Lake Michigan, the Ozark region and also in New Jersey, Delaware, Maryland, Virginia and the cooler parts of the Carolinas, Georgia, Tennessee and Alabama. Unlike European varieties, American grapes are pre-eminently table or dessert fruits, comparatively small quantities being used for wine making. Nevertheless thousands of tons are used annually for making unfermented grape juice. Jam, marmalade and jelly also are made by canning factories in several of the grape growing districts.

Grapes are usually propagated commercially by means of hard wood cuttings, preferably taken after the leaves drop in the fall, then tied in bundles and buried in damp sand in cool cellars. In the spring they are planted in nursery rows and given clean cultivation through the summer. The largest will be of sufficient size for vineyard planting by autumn; the small ones are transplanted and grown a second season in the nurseries. With new, rare and valuable varieties single eye cuttings are often started in greenhouses during the winter or green wood cuttings are taken in the summer. Grafting, especially of European varieties on American stocks to prevent damage by phylloxera, is often done, the point of union being generally below ground.

Pruning and training are essential to the production of both the best quality and the largest quantity of grapes as well as for the convenience of the vineyard. No matter how the vines are supported, whether on posts, trellises, arbors, or porches, three fundamental principles must be observed. 1. Fruit is borne on none but the green shoots of the current season. These shoots spring from buds on canes developed the previous year. 2. The fruit bearing parts of the vine must be kept as close as possible to the root; for the farther away they get the less will be the yield and the poorer the quality. 3. Vines should not be allowed to bear more than 40 to 100 clusters. By noting at pruning time during winter the apparent vigor of each vine and by calculating that each plump bud left on the canes will produce an average of two clusters of grapes it is easy to limit the number of clusters to the vine. In commercial vineyards the vine trunks are carried up and fastened to the trellis along the wires of which the canes are extended and tied each year. Each cane saved is shortened to the desired number of buds, all other growths being cut off.

Grapes thrive best in moderately fertile gravel loams, although some do equally well on well-drained heavy or light lands. One-year plants are usually preferred for commercial planting. Small growing kinds, as Delaware and Jessica, are set 6 by 6 ft.; moderate growers, as Concord, 8 by 8 and rampant ones, as Herbemont still farther. During the first year shallow rooted truck crops, as tomatoes or melons, are often grown between the vine rows to insure the necessary cultivation and help pay ex-

penses. In later years intercropping is not practiced but the vines are given clean culture until midsummer. Then a cover crop is usually sown to protect the ground from washing in fall and winter and to maintain the supply of humus in the soil when it is plowed under in the spring.

The most dreaded insects to which grapes are subject are phylloxera on European varieties, leaf hoppers, leaf folders, flea beetles, berry moths and others. With the exception of the first these may be controlled with comparative ease. The attacks of diseases such as downy and powdery mildew, black and bitter rot, and anthrachose, are more or less successfully prevented by spraying or dusting with FUNGICIDES.

The following varieties suited to the northeast quarter of the United States and adjacent Canada cover a season from August until midwinter in natural storage: Brighton, Lindley, Gaertner, Delaware, Brilliant, Salem, Agawam, Caco, Goethe, and Catawba of the red grapes; Moore's early, Worden, Barry, Herbert, Campbell and Wilder of the black; Portland, Ontaria, Winchell, Diamond, Niagara, Empire and Dutchess of the white. In the middle southeast most of the above do well, also Norton Virginia, America, Beacon, Gold Coin, Lausell, Ozark and Presly. From Tennessee southward and westward to Texas most of those named thrive along with Diana, Herbemont, and Missouri Reisling. The Muscadine varieties, Scuppernong, Flowers, James, Mish and Thomas, are at home in this section. In the southwest thrive the Jacquez, Golden Chasselas, Malaga, Bertrand Carman, Fern, Jaeger, Neva, Perry and Muench.

GRAPE PRODUCTION, U.S.,
4-Year Average, 1927-30

Division	*Production (Tons)*	*% of Total*
UNITED STATES	2,435,855	100.0
LEADING STATES:		
California	2,172,500	89.1
New York	73,672	3.0
Michigan	67,775	2.8
Ohio	22,963	1.0

Most of the above are grown in California as well as European varieties, such as Black Cornichon, Black Hamburg, Emperor, Malaga and Flame Tokay for the table; Black Malvoise, Carnigan, Lunfandel and mission for juice; Sultana, Thompson's seedless, Zanto Currant and Muscat for raisins. M. G. K.

GRAPEFRUIT (*Citrus paradisi*), a round, thin skinned, very juicy citrous fruit of the rue family closely allied to the orange and lemon. Grapefruit was originally native to the Orient whence its culture has spread to warm climates throughout the world. The mature tree has a dome-like top, often exceeds 40 ft. in height and is the most handsome of citrous trees, especially when laden with fruit. The name grapefruit is variously ascribed to the grape-like flavor of the fruit but more probably to its habit of bearing sometimes a dozen or more fruits in a close cluster.

Although the grapefruit seems to have been introduced into Florida about 1809, its culture was restricted to home plantings until after the railways began to extend down the peninsula. Since about 1880 commercial planting has been extensive and Florida orchards now ship hundreds of cars of this fruit to northern and European markets.

In California the grapefruit has been extensively grown for many years but its culture does not compare in importance with the orange or lemon industries of that state. Because most of the Florida varieties have proved unsuited to California conditions and also because seedling and miscellaneous varieties inferior to Florida fruit have been marketed, the development of the industry has been slower than might otherwise have been the case. Until recently the output of California grapefruit has been marketed mainly in the Pacific coast and intermountain states. When properly grown, however, certain varieties compare favorably with the best in Florida. Hybrids between tangerines and grapefruits have been made by Walter T. Swingle of the U.S. Department of Agriculture. Under the general name of tangelos they are being planted commercially.

Like most other citrous fruit trees the grapefruit thrives best in light, sandy, well drained soils. Young and newly planted trees are tender to frost but established ones protect themselves somewhat by their dense foliage and thus resist damage better than do oranges. During warm spells in winter they are also less likely than limes or lemons to make sappy growth tender to frost. Commercial culture is therefore limited to frost-free areas, especially southern Florida. To obtain best results in hardiness, productivity of tree, quantity and quality of fruit, the trees require judicious but liberal feeding. Budded trees, well managed, often begin to bear the fourth or fifth year after planting, reach full bearing in about ten years, and continue indefinitely.

GRAPEFRUIT PRODUCTION, U.S.,
5-Year Average, 1926-30

Division	*Production*
LEADING STATES:	
Florida	9,140,000 boxes
California	892,000 "
Texas	720,400 "
Arizona	203,000 "

Because of its vinous flavor the fruit is highly esteemed as an appetizer, and as an ingredient in fruit salads and desserts. It is candied to some extent and a syrup made as a by-product of the candying. Within recent years methods have been perfected whereby the pulp is separated from the skins, seeds and other waste parts and canned on an extensive scale. M. G. K.

GRAPE-HYACINTH (*Muscari botryoides*), a small early-blooming, bulbous perennial of the lily family widely grown in yards and gardens. It is a

native of south Europe which has escaped from cultivation and run wild in various parts of the United States. The plant bears very narrow leaves and a dense cluster of small pale-blue, reflexed, urn-shaped flowers suggestive of a pigmy bunch of grapes.

GRAPE SUGAR, also known as dextrose, or glucose, is an organic chemical compound belonging to the CARBOHYDRATES. It is a monosaccharose of formula $C_6H_{12}O_6$, and, as its name indicates, occurs in grapes and imparts to them their sweetness. *See also* DEXTROSE, GLUCOSE.

GRAPHICAL METHODS. The extensive use which is made to-day of charts and graphs by newspapers, magazines and business houses in representing clearly and strikingly numerical facts indicates the importance of the graphical method both in acquiring and presenting a certain type of information. The method of charting, which is now centuries old, was, no doubt, first used by the explorer in the making of maps to record the extent of his travels and to serve as a guide for future explorations either by himself or by others. It is only within recent times that this method has been used extensively to record and present useful numerical facts.

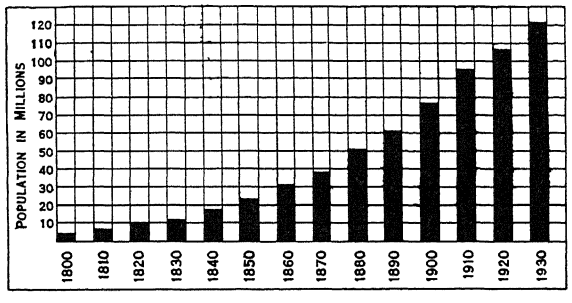


FIG. 1. GRAPHICAL REPRESENTATION OF POPULATION GROWTH

The Pictogram. The most commonly used scheme for presenting statistical or numerical data is the so-called bar chart or bar pictogram. In Fig. 1 the growth of the population of the United States is represented pictorially from the year 1800 to the year 1930. This pictogram is a time chart where the time is represented on a horizontal line, called the time axis, and the population is represented on a vertical line, called the population axis. The circular pictogram is another type which is in frequent use.

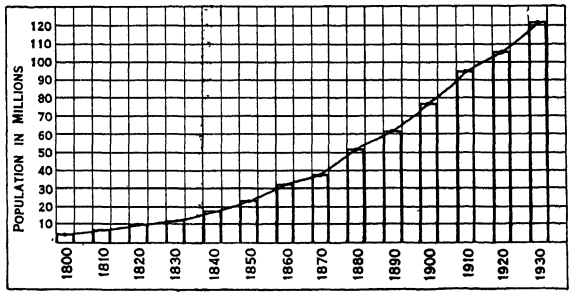


FIG. 2. GRAPH OF POPULATION GROWTH DEVELOPED FROM FIG. 1

As a line-segment can be used to represent approximately a given number, each shaded bar represents approximately the population, or number of people, for the year indicated underneath the bar. Pictograms are not used for an accurate portrayal of facts, but rather to tell a story graphically.

If through the mid-point of the top of each shaded bar a curve line is drawn and then the bars erased as in Fig. 2, the curve line is called a graph. The word is also used, however, to cover a case like Fig. 1, this being then called a bar graph. The graph in this case illustrates the growth of the United States, in population, over the 130-year period beginning with 1800. The advantage of the graph, although not so striking as the bars, lies in the fact that many curves can be put on the same chart.

Directed Line-Segments. If A and B (Fig. 3) are points of an indefinite straight line $X'X$, the line-segment AB may be thought of as traced by a point moving along $X'X$ from A to B or from B to A. If the point moves from A to B, the line-segment which is traced is called the directed line-segment AB. The directed line-segment BA is thought of as being traced by a point moving from B to A. Thus a directed line-segment represents a given length in a given direction.

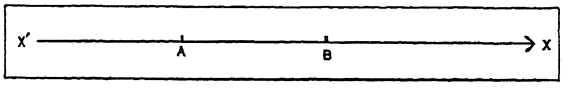


FIG. 3

It is customary to represent the direction to the right as positive and the direction to the left as negative. If in the figure above the distance between A and B is one inch, we write $AB = 1$, or $BA = -1$. It follows from the above discussion that $AB = -BA$ or that $AB + BA = 0$.

It is possible to locate a point in a plane by taking two directed lines at right angles to each other and stating the distance of the point from these two lines. These two directed lines are called a frame of reference, or axes of reference or simply axes. The point, O, which is the point of intersection of the two lines, is called the origin, while the horizontal axis $X'X$ is called the x axis and the vertical axis $Y'Y$ is called the y axis. (See Fig. 4.)

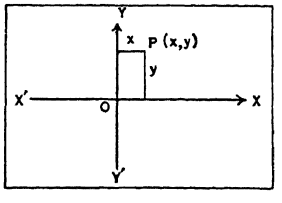


FIG. 4

The distance of the point P from the y axis is represented by the letter x and is called the ABSCISSA of the point, while the distance of P from the x axis is called the ORDINATE of the point and is represented by the letter y. We see that a number pair (x,y) determines a point and conversely, any point P in the plane has a number pair associated with it. In Fig. 5 the number pairs associated with the four points

are shown. Thus the coordinates of A are (3,2); those of B are $(-3,3)$; of C, $(-3, -4)$; of D, $(2,-2)$.

Graphs are also used to show how one quantity varies with another quantity when the two quantities are connected by an equation. For example, disregarding the resistance of the air, the equation $s = 16t^2$ shows the approximate relation existing between the distance through which the body falls and the time t. If we assign values to t and calculate s for these values as shown in the table, these pairs of values, when plotted on graph paper enable us to represent graphically the above law by means of a curve (Fig. 6) which is drawn through the plotted points.

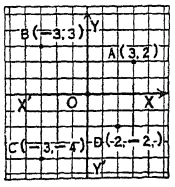


FIG. 5

$t=$	0	1	2	3
$s=$	0	16	64	144

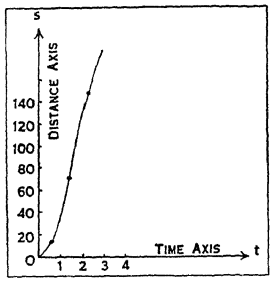


FIG. 6. GRAPHICAL REPRESENTATION OF LAW OF FALLING BODY

Solution of Equations by Graphs. The graphical method is often convenient for finding the approximate value of roots of an equation or of roots of simultaneous equations. For example, for the equation $x^2 - 0.2x - 0.2 = 0$ we put $y = x^2 - 0.2x - 0.2$, and after finding a table of values, we plot the graph as in Fig. 7. From the graph it appears that when $y = 0$, $x = 0.5$ and $x = 0.35$. Thus the approximate roots of the equation are 0.5 and 0.35.

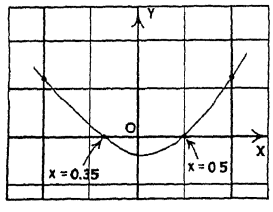


FIG. 7

To find the approximate values of the roots of two simultaneous equations, we take the graphs of each equation on the same set of axes as in Fig. 8, where the two equations are $x^2 + y^2 = \frac{9}{16}$ and $y = x^2$. From the graph we read off the coordinates of the points where the graphs cross. Thus $x = 0.6$, $y = 0.4$ and $x = -0.6$, $y = 0.4$ are the approximate values of the solution of this pair of equations.

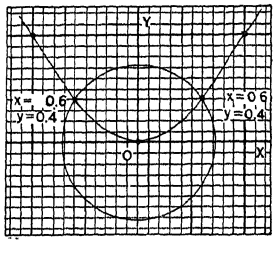


FIG. 8. GRAPHICAL SOLUTION OF EQUATIONS

Graphic Addition and Subtraction. The operations of addition and subtraction are performed graphically with the ruler and compasses, as illustrated in Fig. 9. To find $AB + CD$ or $m + n$, lay off on the directed line $X'X$ the length $AB = m$, and with the compasses lay off $BE = n$ in the direction of AB. Then $AB + CD = AB + BE = m + n$. To find $AB - CD$ or $m - n$, lay off from B, $BF = CD$ in the direction of BA. Then $AB - CD = AB - FB = m - n$.

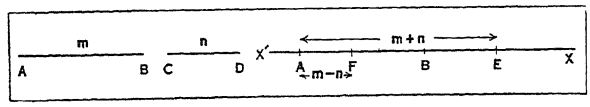


FIG. 9

Multiplication and Division. Multiplication and division may be performed graphically as follows: Let a, b, and c be three given line-segments (Fig. 10). On the x axis lay off c from the origin, and on the y axis lay off a and b as indicated. Join the extremities of a and c and from the upper extremity of b draw a line parallel to MN. Then by proportion $\frac{OS}{ON} = \frac{OR}{OM}$ or $\frac{x}{c} = \frac{b}{a}$ and $x = \frac{bc}{a}$. Now if $a = 1$, then $x = bc$; that is, x is the product of the segments b and c. On the other hand, if $c = 1$, then $x = \frac{b}{a}$ which is the quotient of b divided by a. It is understood that if any line segment represents a negative number, it should be laid off in the negative direction.

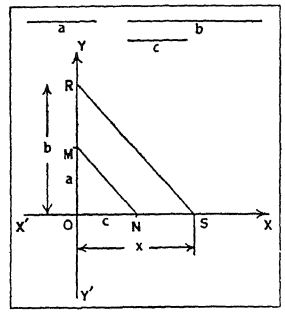


FIG. 10 MULTIPLICATION AND DIVISION BY GRAPHICAL METHOD

Graphical Solution of a Polynomial Equation. If $y = a_0 + a_1x + a_2x^2 + \ldots$, a POLYNOMIAL FUNCTION, the value of y for a given value of x, say $x = m$, can be readily found by the graphical method. On the y axis lay off $OC_1 = a_0$, then $C_1C_2 = a_1$, $C_2C_3 = a_2$, $C_3C_4 = a_3$, and so on, as in Fig. 11, each line segment to be laid off as a directed line segment.

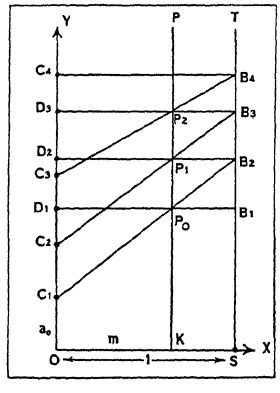


FIG. 11

Take the line ST parallel to the y axis and one unit from it. Then where $x = m$ as shown in the figure take KP parallel to the y axis. From C_4 take the line C_4B_4 parallel to the x axis, and join C_3B_4, cutting RP in P_2. Again take P_2B_3 parallel to the x axis and C_2B_3. Continue this process until the last line C_1B_2 cuts RP in P_0. It can be shown that

$$P_0K = a_0 + a_1m + a_2m^2 + a_3m^3,$$

that is, $y = P_0K$ when $x = m$. From similar triangles $\frac{C_3D_3}{C_3C_4} = \frac{D_3P_2}{C_4B_4} = m$, or $C_3D_3 = a_3m$. Furthermore

$$\frac{C_2D_2}{a_2 + C_3D_3} = m$$

and $C_2D_2 = a_2m + C_3D_3m = a_2m + a_3m^2;$

also $$\frac{C_1D_1}{a_1 + C_2D_2} = m$$

and

$$C_1D_1 = a_1m + C_2D_2m = a_1m + a_2m^2 + a_3m^3.$$

Finally,

$$P_0K = OC_1 + C_1D_1 = a_0 + a_1m + a_2m^2 + a_3m^3.$$

The method explained above for constructing the value of a polynomial function for a given value of x is useful in finding a root of a polynomial equation. For example, to find the approximate value of the positive root of the equation $3.2x^2 + 2.1x - 1 = 0$, we write $y = -1 + 2.1x + 3.2x^2$, and then lay off $OC_1 = -1$, $C_1C_2 = +2.2$, and $C_2C_3 = 3.2$. (Fig. 12.) Two large spaces are taken as one unit horizontally and one large space as one unit vertically. To find the value of y when $x = OK = 0.5$ we draw the lines C_3B_3 parallel to OX, and then join C_2B_2 *cutting* KP in P_1. Where C_2B_3 cuts K draw P_1B_2 parallel to OX. The point P_0 *where* C_1B_2 cuts KP will be a point on the curve. This process is repeated thus locating other points on the curve. It will be observed that it is not necessary to draw the lines shown in the figure in locating points on the curve. For example, a ruler is placed parallel to OX with one edge on C_3 and a pencil point marks B_3. Then the edge of the ruler is placed on C_2 and B_3 and a pencil point marks P_1 where the edge intersects KP. Again place the ruler with the edge on P_1 and parallel to OX and put a pencil point at B_2. Put the edge of the ruler on C_1 and P_1 and mark P_0, which is the point on the curve when $x = 0.5$. Hence without drawing a line, the points shown on the curve may be located. The curve is now drawn through the points indicated and the point where it crosses the x axis (that is, $x = 0.32$) is an approximate value of the positive root of the equation

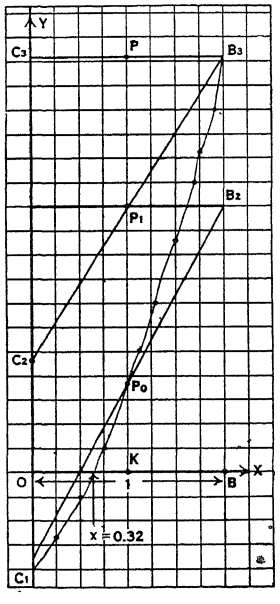


FIG. 12
GRAPHICAL SOLUTION OF POLYNOMIAL EQUATION

$$3.2x^2 + 2.1x - 1 = 0.$$

While this method is of little use for quadratic equations, the type which we have just used to illustrate it is a convenient and quick method for obtaining an approximate root of equations of higher degree.

Nomography. This term was first used by the French mathematician d'Ocagne (1894) to describe the science of making charts suitable for rapid and effective calculation in applied science and mathematics.

A simple nomographic chart for the addition of two numbers a and b can be constructed as follows: Let $x = a + b$, and take three graduated scales which are set parallel to each other as in Fig. 13, with their zero points on the same horizontal line, the x scale being midway between the a and the b scales.

The upward direction of each scale is positive. Take any two points such as N and S on the a and the b scales respectively and join them. Let P be the point where this line cuts the x scale. Since $MNSR$ is a trapezoid, $OP = \frac{1}{2}(MN + RS)$ or $2OP = MN + RS$; or twice the distance on x equals the distance on a plus the distance on b. Hence, if the unit of measure on the x scale is made half as large as the unit on the a and the b scales, then the graduation on x = graduation on a + graduation on b. The graduated scales are shown in Fig. 14. Thus to add 2 and 8, that is, to find x where $x = 2 + 8$, we join 2 and 8 as in the figure and read the result on the x scale.

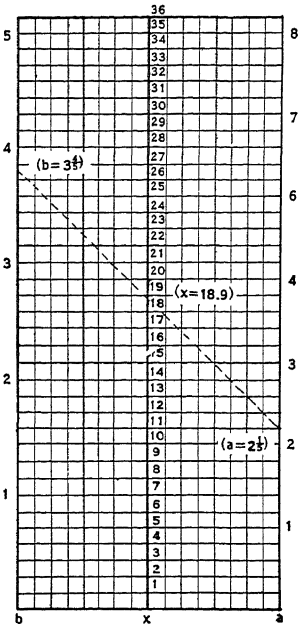


FIG. 13. NOMOGRAPHIC CHART

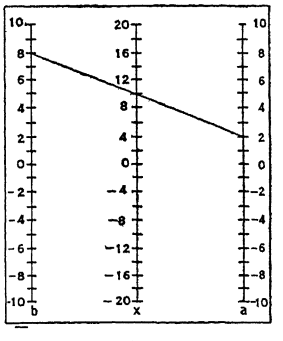


FIG. 14

This serves to show the general nature of nomography, although the device would not be used in practice for such a simple computation. Fig. 15 shows how, on a graph sufficiently enlarged to permit the use of millimeter squares, the system can be used to compute rapidly a large number of values of x for values of a between 0 and 8, and of b between 0 and 5, in the equation $x = 2.5a + 3.5b$. G. W. M.

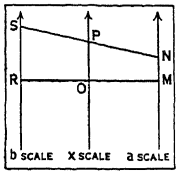


FIG. 15

BIBLIOGRAPHY.—For an introduction to the subject, the following books may be consulted: J. Lipka, *Graphical and Mechanical Computations*, 1918; Brodelsky, *A First Course in Nomography*, 1920; Running, *Graphical Mathematics*, 1922.

GRAPHICAL REPRESENTATION. Often the eye can detect what our other senses fail to apprehend.

It is this characteristic of our seeing that makes a graphical representation of physical phenomena so valuable. A graph or chart representing the relations between various physical quantities may be very helpful and valuable. In the very simple equation, $y = ax$, there are undoubtedly those who read into this equation all the meaning they desire, but for many it adds immensely to its significance to lay a surface off into small squares and plot along a horizontal axis progressive values of x, and along a vertical axis the values of y. In the equation just given, there is, for any value of x, a corresponding value of y, and, if we find these corresponding values and draw a line through the points, we discover that there is a straight line function between x and y.

Let x and y in the equation be certain physical quantities. For instance, let x stand for the time, t, and let y stand for the distance, d, covered by a body moving with uniform velocity. At certain values of t there will be corresponding distances which, when put on a system of rectangular coördinates, will show, in a graphical manner, that the distances covered progress uniformly with the time.

This same method of pictorially showing relationships is very well illustrated in the curves obtained when one sets down, on a system of rectangular coordinates, the values of certain commodities corresponding to a definite time. If this is continued over a series of years, there results a curve which shows how the prices have fluctuated up and down over a considerable period of time.

Graphical representations are not limited to coordinate systems. Suppose we wish to show how a dollar of taxation is spent. A circle is drawn and laid off into sectors, the area of which will correspond to the various avenues into which the dollar goes. Ten per cent will go for one item, and a sector comprising one-tenth of the whole circle will be laid off to represent that part.

For graphical representation of physical relationships, however, there can be no question but what the rectangular coördinates are the most used.

S. R. W.

GRAPHITE, the common constituent of lead pencils and stove polish. It is steel gray to black in color, light in weight and greasy, soiling the fingers. Other names for it are plumbago and black lead, although it has no relation to lead, being pure CARBON. Graphite crystallizes in the rhombohedral division of the HEXAGONAL SYSTEM, whereas the DIAMOND, also pure carbon, is isometric in its habit. The name is derived from the Greek word meaning "to write."

Graphite occurs in scales and in masses in granites, schists and limestones, but the minable deposits are usually in vein form. The crystalline form of graphite is used for making crucibles in which to melt metals. Both amorphous and crystalline graphite serve in manufacturing pencils, lubricants, stove polishes, foundry facings and boiler mixtures. Madagascar and Ceylon are important producers; graphite is also mined in Canada and in the States of Alabama, New York and Pennsylvania. It can be made artificially. *See also* MINERALOGY.

GRAPHOLOGY, the science and art of reading character from handwriting. As ordinarily practiced it is a pseudo-science resting upon plausible assumptions and misleading analogies. It may degenerate to little more than fortune-telling. Graphology errs by insisting on minute interpretations. When it is held that those who write their *o*'s open are generous, and those who close them are close-fisted; that from the manner of crossing *t*'s or dotting *i*'s, one can decide whether the writer procrastinates, has a sense of humor, is persistent, opinionated, sensitive or brutal, the system is clearly an ambitious pretence. Experimental tests have shown that the alleged relations do not exist.

On the other hand, handwriting is an expression of one's mental and motor endowment, and as such, rationally interpreted, carries a rough yet uncertain measure of indication of general characteristics of mental habit. Whether and how far these can be systematized is doubtful. There is accordingly a possible scientific graphology based on experimental analyses. Recognizing the factors of fluency, fashion and mannerism, there remains a considerable amount of suggestive material similar to the handwriting expert's analysis for purposes of deciding the genuineness of documents. That this has a general value as indices of traits may be conceded, likewise that it has been painstakingly set forth by such a graphologist as Robert Saudek in his *Experiments with Handwriting,* 1929; but this in no way justifies the ordinary readings of handwriting.

J. J.

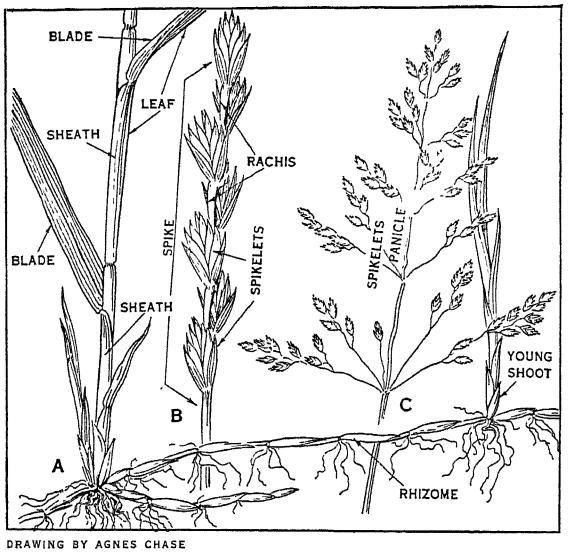
GRAPTOLITES, extinct, colony-forming sea organisms, allied to modern hydroids. The living polyps, each in a horny, cuplike shell, were strung along stems variously branched, or radiating from a central float. Graptolites occur abundantly as carbonaceous films, resembling delicate seaweeds, in fine mudrocks of Cambrian or Silurian age.

Drifting on ocean currents as free-floating colonies, or attached to seaweeds, graptolites attained world-wide dispersal. Similar, or identical species, constituting distinctive fossils in sediments in Scandinavia, Great Britain, and North America, enable geologists to determine the age of the strata. As guide or index fossils, graptolites are thus of paramount importance.

GRAS, FELIX (1844-1901), French poet, who wrote in Provençal, was born in the Vaucluse, May 3, 1844. He was a fervent disciple and follower of FREDERIC MISTRAL and JOSEPH ROUMANILLE, the latter his brother-in-law. He is generally recognized as chief of the second generation of *felibres,* or members of the cult, founded in the middle of the 19th century, which was devoted to the conservation and propagation of the Provençal language. In 1876 Gras wrote *Les Charbonniers,* followed by *Toboza,* a *chanson de geste* in 12 parts dealing with the rising of the Albigenses against Simon de Montfort. The poet died at Avignon, Mar. 4, 1901.

GRASMERE, a village in Westmoreland, England, at the north end of Grasmere Lake, noted for having been the home for 14 years of WILLIAM WORDSWORTH. The natural beauties of Grasmere have been immortalized by the great poet who lived in the village—at DOVE COTTAGE, at Allan Bank, and at the Parsonage —from 1799 to 1813, when he moved to RYDAL MOUNT. Coleridge, it should also be noted, lived at Grasmere in 1809 as a dependent of Wordsworth. Wordsworth, his wife and children, and his sister Dorothy are buried in the village churchyard.

GRASSES. The grasses have been distinguished from very early times as a distinct group of plants. The old Latin name for grass was *gramen,* from which the botanical name of the grass family, *Graminæ,* has been taken. Technically the grasses have two-ranked leaves, jointed stems, and small flowers inclosed in minute green bracts; the flowers usually aggregate in heads, spikes or panicles. A concept of the family can best be formed from the following examples of the group: timothy, redtop, orchard grass, and other meadow and pasture grasses; bluegrass, Bermuda grass, bentgrass, and other lawn grasses; wheat, rye, barley, rice, and other grains; certain large grasses as maize (corn), sorghum, and sugarcane; and bamboos, woody grasses of tropical regions.

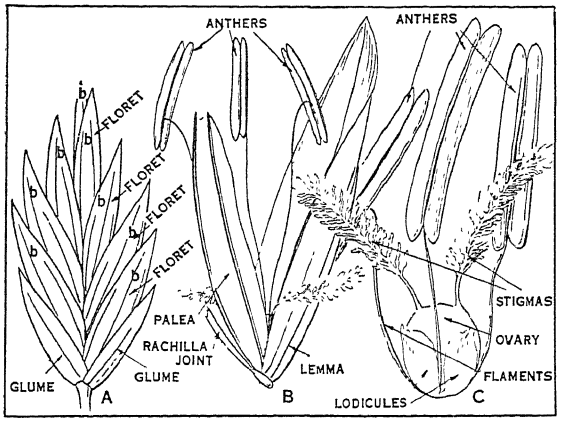


DRAWING BY AGNES CHASE

VEGETATIVE PARTS OF GRASSES

A, Quackgrass, showing creeping rhizomes (rootstocks), rooting at the nodes and sending up a young shoot; culm (stem), showing nodes (joints), with leaves consisting of sheaths enfolding the culm; and blade; B, spike of quackgrass, showing spikelets on opposite sides of a simple rachis, C, panicle of Kentucky blue grass, showing spikelets on pedicels borne in an open panicle

From the economic standpoint the grasses are by far the most important group of plants in the world. The grains are the chief source of vegetable food for mankind; hay and pasture, both cultivated and wild, are the basis of the stock industry from which man derives most of his animal food. The civilizations of the world to-day have been built around certain grasses. Wheat has been the chief basis of the civilization of the white race; rice, for the Chinese, Malays, and related civilizations of the East; maize, for the Maya, Inca, and Aztec civilizations of America;



DRAWING BY AGNES CHASE

FLORAL ORGANS OF GRASSES

A, Spikelet, showing glumes and florets borne on opposite sides of a rachilla; B, floret much enlarged, showing lemma, palea, rachilla-joint and flower; C, grass flower consisting of two minute lodicules, ovary with two feathery stigmas, and three stamens consisting of slender filaments and large two-celled anthers

sorghum and certain other grain-bearing grasses for the more primitive civilization of tropical Africa.

The comparative value of the grasses as crops for 1927 was in round numbers nine billion dollars. Of this more than two billions, or nearly one-fourth of the whole, is credited to maize. Grass in the form of hay, wild and tame, was valued at one and one-third billion dollars, and wheat, barley, oats, and rye together at one and two-thirds billions. Thus, the grass family, not including rice, sugarcane, millets, and other smaller items, accounts for five billion dollars, or more than half of the total of all cultivated crops, which include cotton, tobacco, fruits, and many other items. These statistics do not include the value of pasture which must reach enormous figures.

Besides supplying the breadstuffs of the world and forage for animals, the grasses have other uses. Sugarcane is the chief sugar-producing plant of the world. Corn oil from the seeds of maize is assuming importance. Tons of essential oils used in perfumery are annually extracted from Asiatic grasses, one of which, citronella grass, is the source of the fly dope used by campers. Of esparto, the fiber derived from two grasses of Spain and North Africa, England imports annually more than 200,000 tons for use in paper making. The seed heads (minus the seeds) of broomcorn, a kind of sorghum, furnish the material for brooms. Rice straw is used for matting, oat straw for straw hats, and wheat straw, with special treatment, for Leghorn hats. Bamboos, woody grasses of the tropics, are used for a great variety of purposes. The stems of these graceful plants sometimes rise to the height of more than 100 ft. and may be 8 to 10 in. in diameter at the base. The wood is very hard and durable. The stems are hollow but separated into

compartments by cross partitions. Thus the stems can be used for conduits and water vessels. Bamboo is used for building purposes, for mats, fences, poles, canes, and for other purposes too numerous to mention.

Grasses of certain kinds are of vast importance in land building. Sand dunes along the coasts of Holland, Denmark, and other parts of Europe are held in place by beachgrass, a kind of grass with strong creeping underground stems or rhizomes. Bare sand is easily shifted about by the wind, causing great damage by encroachment on cities, fields or forests. The grass planted upon such areas holds the sand in place so that it ceases to be a menace. The great barrier dunes of Holland, for example, protect valuable land behind them but must be watched with much care. Storms eat into the dunes forming "blow-outs" which would soon make serious breaks in the dunes were they not immediately planted with more grass.

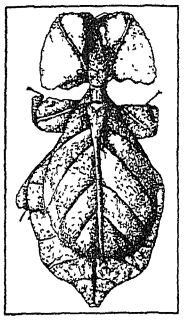
Land building on a gigantic scale is going on to-day along the English Channel and the North Sea by means of a species of *Spartina*. This grass thrives in the soft mud, submerged at high tide, its stout rhizomes forming a dense firm network ever pushing outward. The coarse grass impedes the waves and protects the shore, at the same time causing the water to drop its silt, thus building up the floor until it becomes first marsh meadow, then dry land, when the Spartina dies out, leaving the land for the plow. This process has been going on for ages along our coast by the aid of several native species. The *Spartina* of the English coast, called there ricegrass, was introduced about 1870. It now occupies the tidal flats for 150 mi. along the south coast. The grass is being artificially spread, thus increasing its effectiveness several fold.

In contrast to the useful grasses are injurious species, usually called weeds, which intrude in fields, pastures, and lawns. Crabgrass and sandburs are familiar examples of annual weeds. Quackgrass or couchgrass is an example of a perennial weedy grass with creeping rhizomes. Weeds with rhizomes are difficult to eradicate because the rhizomes can be removed completely only with much labor, and any piece remaining may very soon produce a new plant.

Vast areas on the Pacific coast are invaded and completely occupied by such annual weeds as wild barleys and wild chesses. Some of these have bristly spikes which break up at maturity, each joint having a sharp barbed point and several bristles. The points work into the mouth parts, nostrils, and eyes of grazing animals, causing painful sores and sometimes death.

Decorative grasses include those used for lawns and golf greens, such as bluegrass and the bentgrasses, and common ornamental grasses, such as pampasgrass, giant reed, and eulalia, large kinds for parks, and the pink-flowered fountain grass for the borders of beds of cannas and the like.

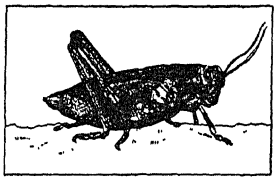
Grasses are used in agriculture chiefly in four ways, for hay, pasture, soiling, and silage. Hay is grass, cut and dried. The foremost hay grass in the United States is timothy, the standard by which other kinds of hay are measured. This is cultivated in humid regions. In certain regions and under certain conditions a few other grasses, such as meadow fescue, orchard grass, bromegrass and Johnson grass, are used. In prairie regions certain wild grasses, such as bluestem, are used for hay. Pasture is inclosed land where grass is grazed. The chief pasture grasses are bluegrass for the North and Bermuda grass for the South. Soiling is the feeding of freshly cut fodder, for which purpose annual plants, mostly grasses, maize, oats, sorghum, and the like, are used. Silage is in a sense, canned fresh grass, such as maize, cut and packed tightly in an air-tight receptacle, the silo. The silage is fed fresh from the silo during the season when fresh grass is not available.



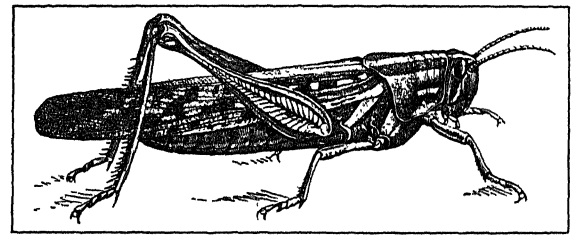
WALKING LEAF GRASSHOPPER

One other immense source of wealth based upon grass is the "range," native grass, especially of our western states, upon which is based the grazing industry. Other plants than grasses are grazed or eaten by the great herds of stock, mostly cattle and sheep, upon our plains and in our western mountains, but grass is the chief constituent of the range. A. S. H.

GRASSHOPPER, the name given to many species of the families *Tettigoniidæ* and *Acridiidæ,* of orthopterous insects. The *Acridiidæ,* or short-horned grasshoppers, include the common varieties as well as the locust and other specialized forms. This family is of great economic importance because of its ravages on agricultural crops. Its eggs are laid in masses, encased in a capsule, usually in the ground. Of the long-horned grasshoppers, or *Tettigoniidæ,* some are carnivorous and some are herbivorous. The eggs are not encased, and are laid on the ground or on the stem or leaves of plants. Both families have well-developed chewing mouth parts, and thickened hind thighs, enabling them to make great jumps. *See* Locust.



LUBBER GRASSHOPPER
Male



GRASSHOPPER
Schistocerca americana

GRASS-OF-PARNASSUS, the common name for a genus (*Parnassia*) of hardy perennials of the saxifrage family. There are about 25 species native to wet soils in north temperate and subarctic regions, 8 of which are found in North America. They are smooth, mostly unbranched plants, about a foot high, with small, usually basal leaves and attractive white or yellow flowers. Most species do well when transferred to moist shady gardens.

GRASS PINK (*Calopogon pulchellus*), a beautiful wild orchid found in bogs and meadows from Newfoundland to Minnesota and southward to Florida and Missouri. The plant, which grows from a solid bulb, bears a single narrow basal leaf and a slender flower-stalk a foot or so high, ending in a showy cluster of purplish-pink flowers. It is one of the most handsome of North American swamp plants.

GRASS SNAKE, a popular name given to snakes making their home in the grass. In the United States it is applied to garter snakes, such as *Eutænia sirtalis* and to one of the green snakes (*Liopeltis vernalis*). In Great Britain it is given to the common European water snake (*Natrix natrix*). *See also* GARTER SNAKE; GREEN SNAKE.

GRASS WRACK (*Zostera marina*), a marine plant of the eelgrass family found widely along sea coasts in the Northern Hemisphere. In North America it is found in bays, coastal streams and ditches from Florida to Greenland and from California to Alaska. The flattened branching stems, which rise from slender rootstocks, bear two-ranked leaves and small inconspicuous flowers borne in a narrow one-sided cluster. The grass wrack is remarkable as one of the few true flowering plants which blossom and mature their seeds under water. The dried stems are extensively used for packing material, especially in southern Europe.

GRATTAN, HENRY (1746-1820), Irish statesman and orator, was born at Dublin, July 3, 1746. He was graduated from Trinity College in 1767 and later studied law at the Middle Temple, London. In 1775-97 he was a member of the Irish Parliament, and after an absence of three years, he returned in 1800 to fight legislative union with England, which, however, was accomplished in 1801. In 1805 he was elected to the Parliament of the United Kingdom, retaining his seat till the year of his death. He was a zealous advocate of Catholic Emancipation and a determined opponent of the union with England. *The Speeches of the Right Hon. Henry Grattan in the Irish and in the Imperial Parliament* were published in 1822 and in the same year an edition of his *Miscellaneous Works*. He died in London, June 6, 1820.

GRAU, MAURICE (1849-1907), Austrian impressario, was born at Brünn in 1849. He came to the United States in 1854, and in 1872 became a concert-manager, arranging tours for ANTON RUBINSTEIN, Salvini, ADELINA PATTI, SARAH BERNHARDT, HENRY IRVING and ELLEN TERRY. During 1891-1903 he was director and lessee of the Metropolitan Opera House, New York, where his régime was described by Henry Krehbiel as "the most brilliant operatic government the world has ever known." He retired in 1903 and died at Paris, Mar. 14, 1907.

GRAVEL, loose rock fragments of small size, usually water-worn and rounded. Strictly speaking, the predominant size in gravel lies between 2 and 10 millimeters, but the term is commonly used to cover a wider range of material. Gravel is ordinarily formed by means of the breaking down of older rocks and the subsequent water or glacier transportation of the coarser and more resistant pieces. Residual gravels are known, especially where CHERT fragments weather out of limestone. These are more angular than the transported variety. Gravel finds its principal use in road-making, for which purpose it should possess certain qualities of packing, cementing and resistance to wear. Gravel is found in nearly all localities; in the United States it is produced chiefly in Pennsylvania, Ohio, Illinois, New Jersey and North Carolina. *See also* EROSION; WEATHERING; DEPOSITS.

GRAVELOTTE, BATTLE OF, Aug. 18, 1870, an engagement of the FRANCO-GERMAN WAR, fought west of Metz. Surprised by Moltke's flank movement around the south of Metz, the French were obliged to abandon their offensive eastward and turn back to defend their communications in the rear. Thus it happened that the battle was fought by the French facing west and the Germans east. Moltke won a complete victory, and Bazaine was forced to fall back upon Metz, where he was besieged and forced to surrender on Oct. 27. German losses numbered about 20,000, while the French losses were 13,000 killed and wounded.

GRAVEL ROADS, earth roads on which the surface is improved with a layer of gravel that takes the abrasion of traffic and also turns water, reducing the absorption and the consequent softening of the supporting earth. Gravel roads were formerly constructed by cutting a "subgrade," filling with gravel, adding sand, sometimes a small amount of clay or other "binder," and rolling the mass to compaction. Modern practice places a thinner layer of gravel on top of a crowned earth surface and "feathers out" the gravel toward the edges. This is rolled into the subgrade and additional material is occasionally spread with a blade grader (*see* GRADING MACHINES), being consolidated by the action of traffic. Such roads will carry 500 vehicles per day without excessive maintenance, but some dust preventive treatment should be used. *See also* EARTH ROADS; OILED ROADS; SURFACE TREATMENT.

GRAVES, FRANK PIERREPONT (1869-), American educator, was born in Brooklyn, N.Y., July 23, 1869. He graduated in 1890 at Columbia and for five years taught Greek at Tufts College. From 1896-98 he was president of the University of Wyoming and from 1898-1903 of Washington University. During the next 17 years he was successively associated with the departments of education at the University of Missouri, Ohio State University and the Univer-

sity of Pennsylvania. In 1921 Graves became president of the University of the State of New York and state commissioner of education. He has been recognized as one of the most important American authors in the field of history of education, among other of his writings being, *A History of Education before the Middle Ages,* 1909; and *A History of Education in Modern Times,* 1913.

GRAVES, places in which bodies of human beings have been buried, generally with a religious motive. Burial of human bodies was practiced as early as middle Palaeolithic times. Upper Palaeolithic burials were not uncommon. They have the following characteristics: Bodies were carefully placed in cavities dug in the earth; cremation, the burning of bodies, was not practiced until Neolithic times. Bodies were generally stretched out, but sometimes buried in a crouched posture. Weapons and ornaments were often buried with the body. Sometimes the body was buried temporarily, then dug up again when the flesh had disappeared, the bones being then buried a second time in their proper position. Bones thus replaced were often painted red. Sometimes the body was buried in a bed of red ochre. In later times a pile of stones or earth was raised over the grave, probably in the case of chieftains. These mounds, or barrows, may be either round or long, according to period or to tribal custom.

GRAVESEND, a river port and municipal borough of Kent, England, on the Thames, 22 mi. southeast of London and within its port precincts. During the Saxon Era it grew up around a hythe or landing-place, and acquired importance after the Conquest. Since Frobisher and Cabot, Gravesend has been a famous port of call for outward bound vessels, and in the early 17th century was the chief station for East Indiamen. In 1617 POCOHANTAS died in the town and was buried in its parish church. Elizabeth made Gravesend the official point for welcoming distinguished foreigners to London, and in 1863, carrying on the custom, it was there that the Prince of Wales (Edward VII), received his prospective bride, the Princess Alexandra. The picturesque older section of the town has the Decorated 14th century Milton parish church and earthworks originally of the reign of Charles II. A yachting and shipping trade center, Gravesend also has iron foundries and shipyards and grows fruit and vegetables for the London markets. Pop. 1921, 31,171; 1931, 35,490.

GRAVIMETRIC EXPLORATION. *See* EXPLORATION, GRAVIMETRIC; GEOPHYSICS.

GRAVITATION, or gravity, the principle of universal attraction, according to which any two particles of matter attract each other with a force proportional to the product of their masses and inversely proportional to the square of the distance between them. To evaluate the exact amount of the force in a concrete case, it is necessary to know the value of the constant of gravitation. This is defined as the force between two bodies with a mass of one gram each, at a distance of one centimeter from each other. This constant of gravitation is believed to be an absolute constant of nature, the same throughout the cosmos.

Compared with other forces acting between bodies of ordinary size, such as electric, magnetic or elastic forces, the gravitational force is exceedingly small, and it derives its importance in the universe solely from the fact that it is universal and affects *all* matter, whereas the other forces apply only in specialized conditions, as well as because the masses of the earth and other celestial bodies are so enormous. The principle of gravitation underlies all CELESTIAL MECHANICS and determination of ORBITS, and the fact that it alone is capable of describing and explaining the relative motion of DOUBLE STARS is considered as proof that gravitation is indeed a universal property of matter.

More recent developments in the theory of relativity have brought some trifling modifications in the enunciation of the principle as given above. Furthermore the modern tendency is to regard the motion of bodies not as the result of such a gravitational force but as a result of a curvature of space in the neighborhood of ponderous matter, in which curved space a material body follows the line of least resistance. W. J. L.

GRAVITATIONAL CONSTANT. *See* CONSTANTS, PHYSICAL.

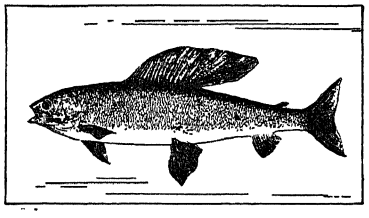
GRAVITY CONCENTRATION, in ORE TREATMENT, a method of separating valuable ore from gangue by virtue of their differences in density. Coarse material is treated on JIGS. A pulsating column of water classifies the ore charge onto a screen into layers, the heavy particles collecting at the bottom and the lighter, usually gangue, at the top. The top layer of waste material is washed away, while the heavy portion containing the valuable metals is drawn off separately. Finer crushed ore is treated on concentrating tables. The ground ore is stratified by an oscillating motion of the table combined with a washing process, the heavy grains going to the bottom, the light ones to the top. In the Wilfley table, which has a riffled surface, a jerking action throws the heavy particles of ore toward the end opposite the driving mechanism, while the lighter particles are washed across the table into the TAILINGS box. B. L.

GRAY, ASA (1810-88), American botanist, was born in Paris, New York, Nov. 18, 1810. His father, a tanner, placed him for study with a physician. Gray obtained a doctor's degree from Fairfield College; but spent considerable time collecting local flora. As curator of the New York Lyceum of Natural History he began the career which was to make him one of the world's outstanding botanists. With Dr. John Torrey, Gray started identifying and classifying the flora of North America according to the new, natural system of botanical arrangement. In 1836 his *Elements of Botany* was published. He was appointed Fisher professor of natural history at Harvard in 1842. Among his more popular writings are *How Plants Grow,* 1858, and *How Plants Behave,* 1872. Most important scientifically is the *Manual of the Botany of the Northern United States.* He died at Cambridge, Mass., Jan. 30, 1888.

GRAY, ELISHA (1835-1901), American inventor, was born Aug. 2, 1835, at Barnesville, Ohio. While studying physical science, he supported himself by working as a carpenter. He became chief electrical expert at the Western Electric Co., of Chicago, and at the Columbian Exposition in 1893 and was chairman of the International Congress of Electricians. Gray patented an electric switch and annunciator, appliances for multiplex telegraphy, the telautograph and many other inventions. He also filed a caveat for the speaking telephone, but the patent was awarded to ALEXANDER GRAHAM BELL. He died at Newtonville, Mass., Jan. 21, 1901.

GRAY, THOMAS (1716-71), English poet, was born at London, Dec. 26, 1716. He was educated at Eton and at Cambridge University. In 1739, accompanied by HORACE WALPOLE, he began a tour of the Continent which was to last two years. After his return to England he wrote the *Ode on a Distant Prospect of Eton College* and the *Hymn to Adversity*. Gray went back to Peterhouse, Cambridge, received his bachelor's degree in civil law, and became a resident of the college. In 1751 his most famous poem, the *Elegy Written in a Country Churchyard,* was published, and established for its author a most important place in the history of English poetry. When middle-aged, Gray passed from Peterhouse to Pembroke College, and in 1768 he was offered the professorship of modern history at the university, which he accepted. During his residence in Cambridge, he wrote the remainder of his most outstanding poems, the *Pindaric Odes, The Progress of Poesy, The Bard,* and the *Installation Ode*. Gray's total poetic output, though of comparatively small amount, was a profound influence on English literature, and his *Elegy* has retained its position as unassailably one of the finest poems in the language. The poet died at Pembroke College, Cambridge, July 30, 1771.

GRAYLING, a food and game fish of the highest quality, frequenting the cold, swift streams of northern Europe, Russia, and North America. The graylings, closely related to the salmon, form a separate group (*Thymallus*) with about 6 variations. The



MONTANA GRAYLING
(Thymallus montanus). An attractive species for the aquarium

Michigan grayling (*T. tricolor*) has a slender body about 18 in. long, colored with grayish purple on the sides, darker above; the ventral fins have diagonal lines, shaded with rose and the dorsal fin is black, rose, and green. It is much like the TROUT in habit and shows the same fighting qualities to the angler. In the arctic regions of Canada and Alaska, the arctic grayling, or poisson bleu (*T. signifer*), is less highly colored, dark blue predominating.

GRAYSON, DAVID. *See* BAKER, RAY STANNARD.

GRAYS PEAK, a mountain in the Front range of the Rockies, situated in Summit Co., Colorado. It is the eighth highest elevation in the state, attaining a height of 14,274 ft., and lies on the Continental Divide. During the ice age an enormous glacier lay in the angle between Grays Peak and Mt. McClellan to the east and carved out a great amphitheater in the rocks. Near here was the famous Silver Plume mine which produced over $29,000,000 in silver. The peak was named for ASA GRAY.

GRAYWACKE, a gray to brown or black rock which contains, in addition to the particles of quartz and feldspar which characterize ARKOSE, fragments of other rocks, such as shale, granite, basalt and bits of minerals, as hornblende, garnet, and others. It is, in fact, a fine-grained CONGLOMERATE.

GRAZ, capital of Styria, Austrian since 1192. It is located on the River Mur and is surrounded by mountains. The old Schlossberg castle, which is now surrounded by large parks in place of earlier fortifications, is the center of the inner city. There are 25 churches and 15 monasteries. The late-Gothic cathedral, built about the middle of the 15th century, a mausoleum church in Baroque style and the former imperial castle are noteworthy among the buildings. Graz has a university, a technological institute and many other educational, as well as charitable, institutions. Though not as highly developed there as elsewhere, the industrial enterprises are important. The chief products are machines, iron ware, railway cars, chemicals and wine. A large trade is carried on in grain and cattle. Graz was the scene of communist uprisings in 1919 and of food riots in 1920. Pop. 1923, 152,706.

GREASE, LUBRICATING, a product obtained by combining a mineral oil with a vegetable or animal fat in presence of a saponifying agent (*see* SAPONIFICATION), which transforms the fluid oil and fat into a vaseline-like solid.

Two basic types of grease predominate, viz., soluble and insoluble, the former saponified with sodium, and the latter with calcium compounds. Sodium base grease withstands high temperatures, and includes such grades as fiber, transmission and synthetic fat cup greases.

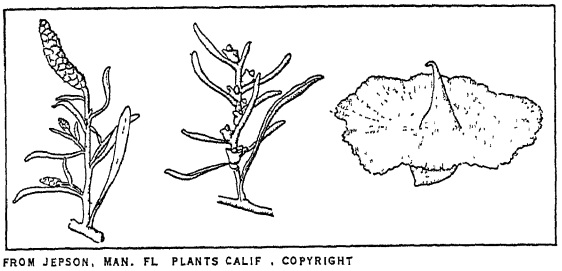
Aluminum base grease is insoluble, but is not as stable as that with a calcium base. The latter, combined with oil under pressure and freed from moisture, will withstand temperature equally as well as an aluminum base grease and is just as translucent. The consistencies most in demand are motor-cup and pressure-gun grease.

Lead-base grease is preferred in the automotive industry. Research has proven a properly selected lead-and-sulphur base coupled with a highly viscous oil is satisfactory, although a high-molecular mineral oil or

specialized sulphur base soluble in refined lubricating oil also produces a non-breakable film at high temperatures. J. McK.

GREASE TABLE, in ore treatment, a concentrating table for the recovery of diamonds, comprising an endless belt, provided with a device to keep it covered with grease for which diamonds have a high affinity; another device scrapes off the grease containing the diamonds. Waste rock will not stick to the grease, and is washed off the belt by a stream of water. *See also* VANNER; ORE TREATMENT.

GREASEWOOD (*Sarcobatus vermiculatus*), a compact, somewhat thorny shrub of the goosefoot family found from Saskatchewan to Texas westward to Washington and California. It grows usually from 3 to 10 ft. high with stiff, closely interlacing branches, white bark, very narrow, fleshy leaves and inconspicuous greenish flowers. The fruit, a broadly



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

GREASEWOOD

(Sarcobatus vermiculatus). Staminate flowering spike, pistillate flowering spike and fruit

winged achene containing a small seed, ripens in autumn. Greasewood, a characteristic shrub of clayey, alkaline and saline soils, is often abundant in desert valleys. Unlike sagebrush, which occurs in fertile lands, greasewood grows mostly in soils unfit for cultivation. The name greasewood is applied to various other closely related plants, especially the SALTBUSH, the IODINE BUSH and the hop sage (*Grayia spinosa*).

GREAT BARRINGTON, a town including several villages in Berkshire Co., southwestern Massachusetts. Great Barrington village is situated on the Housatonic River, 20 mi. southwest of Pittsfield and is served by the New Haven Railroad, and by motorbuses and an airport. The town is a residential and farming community in the beautiful Berkshire hills. There are some factories making chiefly cotton products, bedspreads, vacuum containers and writing paper. Great Barrington gains substantial profits as a summer resort. The town was founded in 1730 and incorporated in 1761. It was a center of violence during Shay's rebellion, 1787. WILLIAM CULLEN BRYANT lived here. Pop. 1920, 6,315; 1930, 5,934.

GREAT BASIN, a division of western United States bounded by the Sierra Nevada Mountains on the west, the Columbia plateau on the north, the Rocky Mountains on the east. It tapers south almost to the Gulf of California, and is roughly triangular in shape, measuring about 800 mi. from north to south, 500 mi. at its widest point, with an area of about 208,000 sq. mi., including the western part of Utah, almost all of Nevada and contiguous parts of Idaho, Oregon and California. This region consists of not one but a number of basins, some connected, others closed, but as a whole has no drainage outlet to the ocean. It is characterized by isolated, narrow mountain ranges separated by broad valleys of varying heights. DEATH VALLEY toward the south is below sea level.

Drainage from the high mountains on the east and west flows into various basins to form lakes, chief of which are Great Salt, Utah and Sevier in the eastern part and Owens, Mono, Walker and Tahoe in the west. The lake waters are saline due to concentration of minerals caused by evaporation which varies from 60 to 150 in. a year. Extensive deposits of potash, soda and borax are found. The heat in summer is intense and the climate is arid, making the region largely a desert except for irrigated areas along stream valleys and at the bases of mountains. Its eastern border is one of the principal irrigated districts in the United States. Grazing is the most important industry.

GREAT BEAR, or Big Dipper, a large northern constellation. *See* URSA MAJOR; STAR: *map.*

GREAT BEAR LAKE, a large body of water in the MacKenzie district of Northwest Territories, Canada. It is very irregular in shape with a length of 75 mi., a breadth varying from 25 to 45 mi., and a surface area of about 11,821 sq. mi., part of which is within the Arctic Circle. The average depth of the water is 270 ft. and the elevation of the surface above sea level is 200 ft. The lake is open only three months of the year. Near Fort Norman it discharges by the Great Bear River into the MacKenzie River.

GREAT BEND, a city a few miles west of central Kansas, the county seat of Barton Co., situated on the Arkansas River, 125 mi. northwest of Wichita. Bus lines and two railroads serve the city; there is also an airport. Great Bend is a shipping center for livestock and grain, and has flour mills and elevators. Lake Barton, an attractive summer resort, Lake Cheyenne, the Federal game preserve, and Pawnee Rock, marking the scene of Indian battles on the Santa Fé trail in the early days, are nearby. The city was founded and incorporated in 1872. Pop. 1920, 4,460; 1930, 5,548.

GREAT BRITAIN, the largest island of Europe, lying between 49° 57′ and 58° 40′ N. lat, and between 1° 46′ E. and 6° 13′ W. long. It is bounded on the north by the Atlantic, on the east by the North Sea, on the south by the English Channel, and on the west by the Atlantic, the Irish Sea and St. George's Channel. The greatest length is 608 mi. and the greatest breadth about 325 mi. The area is 88,226 sq. mi. The island was formerly joined to the European mainland, the connection having been severed in only comparatively recent geologic times. Consequently, many of the major physical features

of Great Britain are extended eastward into the continent. Thus the old resistant rocks of northern Scotland are prolongations of those of Scandinavia; those in southern Wales have their counterpart in Brittany. Likewise, the chalk cliffs of Dover are duplicated across the Strait of Dover in France. Though limited in area, the relief is extremely varied. The major highland areas extend in an almost continuous chain from northern Scotland to the most southern tip of England. The plains areas are in two sections: the English lowlands occupying southeastern England, and a second lowland running across the backbone of older rocks through central Scotland. During the glacial period, ice covered all of Britain except that part of England south of the Severn and Thames rivers. North of this line the work of the ice is everywhere evident, both in its depositional and erosional features. *See also* ENGLAND; SCOTLAND; WALES.

GREAT CIRCLE, any circle drawn on a sphere which is formed as the line of intersection between the surface of the sphere and a plane passing through its center, and the largest circle that can be drawn on a sphere. All great circles are therefore alike in size, being equal to the circumference of the sphere. The EQUATOR whose plane passes midway between the poles and all meridians which pass through the poles are great circles; but the parallels of latitude are not. The great circle passing through two points indicates the shortest distance between them; hence its importance in navigation as great-circle sailing.

GREAT FALLS, an industrial city in northwestern central Montana, the county seat of Cascade Co., situated on the Missouri River, 181 mi. northeast of Butte. Two interstate air lines and two railroads afford transportation. Great Falls lies within an important mining district, producing copper, lead, zinc, also oil. The chief industries are copper and zinc smelting of products of mines as far south as Butte. In 1929 the value of the industrial output was about $9,000,000; the retail trade amounted to $25,685,807. Live stock and wheat are raised in the vicinity. The city has packing houses, flour mills, an electrical products factory and oil refineries. Giant Springs is an interesting feature of the city. This region has beautiful scenic spots, such as the Lewis and Clark National Forest, covering 2,000,000 acres, Rainbow Falls and Sun River Valley. Great Falls was founded in 1882; incorporated in 1888. Pop. 1920, 24,121; 1930, 28,822.

GREAT FALLS, a series of cascades on the Missouri River in Montana. At the point where the plains meet the mountains, the Missouri has a total fall of 612 ft. in 10 mi., the greater part of which occurs in five places, Black Eagle, Coulters, Rainbow, Crooked and Big Falls, collectively known as Great Falls. The city of Great Falls has been built at this point and the water power of the falls has been developed by a hydroelectric plant with a capacity of 165,000 h.p. The current produced is used for heating and lighting the city, for the smelting of ores and to operate a transcontinental railroad across the state. The cascades at Great Falls were discovered by Lewis and Clark in 1805 and described in their journal as one of the grandest sights in nature.

GREAT ICE BARRIER. *See* ANTARCTICA.

GREAT LAKES, THE, a group of five fresh water lakes of east central North America, forming the boundary line separating the United States and Canada between 92° 06′ and 76° 10′ W. long. and 49° 00 and 41° 23′ N. lat. They include lakes Superior, Huron, Erie and Ontario which are divided between the two countries, and Lake Michigan which lies wholly within the United States. By connecting waterways these lakes become one great system and constitute the largest body of fresh water in the world with a total area of 94,710 sq. mi. They drain a basin covering 291,670 sq. mi. including parts of Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania, New York and the province of Ontario. This region lies between the Hudson Bay drainage system on the north and the Mississippi River watershed on the south and west.

Lake Superior, situated farthest north and west in the chain, is the largest of the group and has the greatest elevation, 602.23 ft. above sea level. It drains into Lake Huron through St. Mary's River, a stream about 63 mi. long with a fall of 21.29 ft., which makes the surface of Lake Huron that much lower than Superior. Lake Michigan also drains into Lake Huron through Mackinac Straits which occur near the mouth of St. Mary's River. As the straits have no fall, Michigan has the same mean elevation as Lake Huron. The latter lake empties into Lake Erie through a 100-mi. waterway composed of St. Clair River, St. Clair Lake and Detroit River. These three have a moderate descent which brings the elevation of Lake Erie down 8.51 ft. below that of Huron. Lake Erie in turn drains into Lake Ontario, the smallest of the group, through Niagara River, a stream 26 mi. long with a descent of 326.32 ft., 167 ft. of which goes to make up the world-famous Niagara Falls. Lake Ontario at the end of the chain empties into the great St. Lawrence River which discharges at the rate of 240,000 cu. ft. per second. This river is about 750 mi. long and flows into the Atlantic Ocean.

These Great Lakes constitute one of the most important commercial waterways in the world. In 1929, exclusive of Canadian traffic, they carried 297,182,061 tons of freight worth $4,294,385,683, which is 90% of that cleared through the combined Atlantic, Gulf and Pacific ports. The principal items in this tonnage were irons and metals taken from the great Mesabi range in Minnesota and from the copper and iron fields in northern Michigan; non-metallic minerals such as coal, limestone, sand and gravel distributed to various industrial centers in the lakes region; and millions of bushels of wheat and other vegetable food products carried to domestic and foreign ports.

There is continuous navigation from the head of Lake Superior to the mouth of the St. Lawrence by means of canals and other improvements. The Sault

Ste. Marie canals and locks built on both the Canadian and American sides of St. Mary's River and connecting Superior and Huron, form one of the greatest artificial waterways in the world, handling each year more traffic than any other canal. The WELLAND CANAL which parallels the Niagara River, connects Port Colborne on Lake Erie with Port Dalhousie on Lake Ontario. It was opened in 1829 and has since then been greatly enlarged and improved, now having eight locks throughout its length of 27 mi. In addition there is the Erie Canal reaching from Tonawanda, N.Y., to Troy, N.Y., and connecting Buffalo on Lake Erie with the Hudson River which leads to the Atlantic Ocean. Three of the six largest cities of the United States, Chicago, Cleveland and Detroit, are situated on the shores of the Great Lakes. The population of the eight American states and the Canadian province bordering on them, exceeds 45 million.

The Great Lakes have had a momentous influence in the industrial development of eastern United States and Canada. They were discovered one by one in the first half of the 17th century by French explorers seeking a northwest water passage to the Pacific and by French priests who came to establish missions among the tribes of Iroquois, Hurons and Chippewas. The names of Champlain, LaSalle, Hennepin and Marquette are prominent in their early history.

In 1679 LaSalle built the first sailing vessel to navigate the lakes. This was the *Griffon* launched on Lake Erie, which reached Green Bay, Wis., and on its return trip disappeared in Lake Huron. Active commercial traffic on the lakes began after the American Revolution with salt and furs as the chief cargoes. The most prominent American fur trader was John Jacob Astor, with important trading posts at Detroit and Mackinac. In 1838 the first wheat was shipped from Chicago to Buffalo, then a 14-day trip, and in the 1840's the discovery of copper and iron deposits started a great wave of emigration by lake routes to northern Michigan. Cultivation of the fertile agricultural lands to the west and south followed the discovery of metals, and with the easy and cheap distribution of commodities by water, the east began to depend on the west for wheat and iron ore. The giant Mesabi iron range of Minnesota was opened in the eighties.

In less than 70 years the cargoes carried by the lakes increased from about 500 thousand tons to nearly 300 billion.

GREAT NECK, a suburban residential village on the north shore of Long Island in Nassau Co., N.Y. It is situated on Manhasset Bay, Long Island Sound, 15 mi. east of New York City. The Long Island Railroad and motor bus lines furnish transportation. It is a popular summer resort and suburban home for New York business men. The village was incorporated in 1922. Pop. 1930, 4,010.

GREAT PLAINS, a broad belt of highlands in western United States, sloping eastward from the Rocky Mountains to the central lowland or prairie region. It extends into Canada on the north, to the coastal plain on the south and includes central and eastern Montana, the eastern parts of Wyoming, Colorado and New Mexico, and the western sections of North Dakota, South Dakota, Kansas, Nebraska, Oklahoma and Texas. The eastern boundary coincides approximately with the 100th meridian and is defined generally by an east-facing escarpment having an elevation of 1,500 to 2,000 ft. The western edge has an altitude of 5,500 ft., giving the plains a slope of 10 ft. per mi. over their width of 400 ft.

North of the Nebraska line the region is called the Missouri plateau which includes the Bad Lands and Black Hills of South Dakota. South of this line are the High Plains or short grass country, a remarkably flat, treeless area including the Staked Plains of Texas. These are the leading grazing regions of the United States. The climate is semi-arid, making irrigation necessary for agriculture. Ground moisture and artesian wells are the chief sources of water. The plains are crossed by the Missouri, North and South Platte, Arkansas, Canadian and Red rivers.

GREAT REBELLION, THE. In June 1642 the English Parliament demanded of Charles I a number of concessions which would have in fact ended his sovereignty. Charles refused and prepared for war. Parliament then voted an army and appointed a general to lead it. Such a levy of troops contrary to the royal will was an act of rebellion, and inaugurated the civil war which is commonly known as the Puritan Revolution. *See* ENGLAND, HISTORY OF.

GREAT SALT LAKE, a large lake in northern Utah, having an altitude of 4,218 ft. It is situated in the area between the Wasatch and Sierra Nevada mountains, called the Great Basin, which has no outlet to either ocean. This basin contains many small mountain ranges separated by broad valleys which are mostly deserts. The mountains send down few permanent streams and nearly all are absorbed immediately by the soil or flow into salt lakes. Great Salt Lake receives most of its drainage from the Wasatch Mountains. As it has no outlet, its waters would rise were it not for the rapidity of evaporation due to the arid climate. Its waters are now about one-fifth salt.

Geological investigations have disclosed the fact that a large fresh water lake with as great an area as that of Lake Huron, formerly filled the basin surrounding Great Salt Lake and had an outlet into the Columbia River. This is now referred to as Lake Bonneville. Where Salt Lake City now stands it had a depth of 1,000 ft. and its shore line is still marked on the slopes of the Wasatch Mountains and other ranges. Great Salt Lake is the shallow bed of the former lake. It has a surface area of 1,750 sq. mi. and an average depth of 40 ft.

GREAT SAND DUNES, a national monument in the San Luis Valley, south central Colorado, established Mar. 17, 1932 under the administration of the National Park Service. The dunes are a highly picturesque collection of windblown mounds of sand,

rising in some cases to a height of almost a thousand feet, and are among the largest and highest, if not actually the greatest sand dunes in the United States. A barrier for the dunes is formed by the Sangre de Cristo mountain range. The monument, which comprises an area of 46,034 acres, lies between the Arkansas and Rio Grande rivers and is reached from Mosca on the Denver and Rio Grande Western railroad.

GREAT SLAVE LAKE, an extensive lake in the MacKenzie district of Northwest Territories, Canada, situated between 61° 41′ and 63° N. lat. and 10° 30′ and 17° 30′ W. long. It is 300 mi. long from east to west, has an average breadth of 46 mi., and a water surface of 10,719 sq. mi. The elevation above sea level is 391 ft. Its coast line is very irregular and its surface contains many rocky and wooded islands. Great Slave River empties into it from the south, and it discharges into the Arctic Ocean through the MacKenzie River. Its waters are very clear and deep and are frozen over fully six months of the year. Near the inflow of Great Slave River is Fort Resolution, an important Hudson Bay post, where there are also Anglican and Roman Catholic missions.

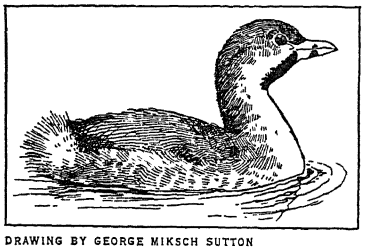
GREAT TRAIL, THE, a famous Indian path between the Forks of the Ohio and the present Detroit. The route followed the north bank of the Ohio to the mouth of the Beaver; followed the watershed to the present Bolivar, at which point it crossed the Muskingum River, and continued by way of the present Wooster and the Raisin River to Detroit. It was a westward extension of NEMACOLIN'S PATH, and in the Revolutionary Era became the most important route west of Pennsylvania. One of its tributary trails, the Scioto-Beaver trail, was the main thoroughfare of travel between the Shawnee and Delaware nations, and was traversed by Christopher Gist in his explorations for the OHIO COMPANY.

GREAT WALL, the long line of defences stretching along the crest of the mountains which divide China Proper from Mongolia. Short sections of defences against invasions from the north were built by the Chinese in early times. In the years ending in 214 B.C., Chin Shih Huang Ti, emperor of China, reconstructed and connected these defences to form the Great Wall. Later emperors built additions and branches. As the wall now stands, it stretches for over 1,500 mi., from the sea at Shanhaikwan to the borders of Chinese Turkestan (Sinkiang). The wall is faced with slabs of stone, or, in some parts, huge bricks, and is filled with earth. At the base it is some 20 ft. wide, and along the top is a roadway 15 ft. wide. The wall averages 20 ft. in height. Large watch towers are located at strategic points, and smaller towers at intervals of approximately a hundred yards. Tradition has it that over a million men were engaged in building the wall, under Chin Shih Huang Ti. It is said that the Great Wall is the only structure which men have built which could be seen from Mars.

GREBE, the name given to a family (*Colymbidae*) of diving birds closely related to the loons. There are about 25 species, found nearly throughout the world, six occurring in North America, chiefly in fresh water, but in winter and during migrations often taking to the sea. Grebes are much smaller than loons, few measuring 20 in. in length, with short bodies, inconspicuous tails, lobed feet and legs placed so far back on the body as to make them helpless on land. Their plumage, chiefly brownish or blackish above and glossy white below, is in many species decorated in summer with bright markings.

Slow and awkward on foot and rarely adventuring on land, grebes are exceedingly expert swimmers and divers. When pursued they can swim with only the tip of the bill out of water. They feed chiefly upon fish and other aquatic animals and plants; their call is usually a harsh croak. In their nests, which are usually floating masses of water weeds or rushes often anchored to some aquatic plant, they lay 3 to 9 bluish-white eggs.

The best known North American species is the pied-billed grebe (*Podilymbus podiceps*), variously



DRAWING BY GEORGE MIKSCH SUTTON

PIED-BILLED GREBE

known also as hell-diver, dabchick, dildapper and water witch. In Lake Titicaca, Peru, there is a peculiar flightless grebe (*Centropelma micropterum*) with very rudimentary wings. A. B. J.

GREECE, a country of Europe, the southernmost of the Balkan states, embracing an area of 49,912 sq. mi. and surrounded by seas on all sides except in the north, where it is bounded by Albania, Yugoslavia, Bulgaria and Turkey. The Albanian frontier begins at Butrinto, on the Ionian Sea, and runs northward through Epirus, meeting the Yugoslav border south of Lake Ochrida. From here on the dividing line proceeds directly eastward through Macedonia, ending near the town of Petrich, where Bulgarian land is met. The Greco-Bulgarian frontier continues south of Mt. Pirin and the Rhodope Range to a point just north of Adrianople, where the Greco-Turkish boundary begins and proceeds in a straight southerly direction along the current of the Maritza River to its mouth in the Aegean. On all other sides Greece is bounded by seas, the Ionian in the west, the Aegean in the east, and the eastern Mediterranean in the south.

Surface Features. Greece is a maritime country, composed of mainland and dozens of islands. To the west of the mainland is the group of Ionian Islands, of which the principal ones are Corfu, Santa Maura, Cephalonia and Zante. In the south is Crete,

the largest of the Greek islands. Crete was taken from Turkey in 1912; the Ionian group was ceded to the kingdom of Greece in 1863 by Great Britain, under whose protection it had been. North of Crete are the Cyclades, among which are Naxos and Andros. Of the Northern Sporades, in the middle of the Aegean, Skyros is the most important. Farther north are Lemos and Thasos, and along the eastern shore of the Aegean, close to the coast of Anatolia, are Chyos and Mytiline. Thus, with the exception of Imbros, which is held by Turkey because of its strategic position at the entrance to the Dardanelles, and the group of twelve islands farther south known as the Dodecanese, among which is the large and historic island of Rhodes, all the Aegean archipelago belongs to Greece. *See* separate articles on these islands.

The mainland is separated into two chief divisions by the Gulf of Patras, the Straits of Lepanto and the Gulf of Corinth. South of this narrow strip of water is the Peloponnesus, an insular body of land comprising nearly one-fourth of the entire area of Greece. The Peloponnesus is a series of hills and basins with flatlands of considerable fertility along the coast. The hills are generally low. Mt. Pegas, in the western part, is the highest elevation, rising to a height of 8,000 ft. above sea level. To the north of the Gulf of Patras and the Gulf of Corinth is the actual mainland of Greece, with the old provinces of Attica and Boeotia, with the fertile region of Thessaly and the new territories in the Epirus, Macedonia, Thrace and Chalcidia. Mountain ridges intercepted by low depressions, traversed by small rivers and dotted with towns and villages, is the aspect of old Greece. Mt. Giona, rising to a height of over 8,000 ft., is the highest peak in old Greece, but Mt. Olympus in the north, which lifts its snowcap to a height of almost 10,000 ft. above sea level, is the highest mountain not only of Greece but of the entire Balkan Peninsula. The Epirus is mostly upland country crossed by the Pindus Range on whose slopes graze the flocks of the Vlach shepherds. Thessaly consists of two main valleys drained by the Salambria River on whose banks are the important towns of Trikala and Larissa. Macedonia, Thrace and Chalcidia, all acquired during the first Balkan War in 1912, are mountainous only in spots and are the richest agricultural regions of Greece.

None of the rivers of Greece is large enough to admit vessels. The Maritza is navigable to small craft from its mouth to Adrianople, but only the right bank belongs to Greece. The other rivers of new Greece are the Vardar, the Mesra and the Strouma. They all descend from the north, the first from Yugoslavia, the latter two from Bulgaria. After traversing the narrow strip of Greek land along the Aegean they enter that sea. The Bistritza, rising in southern Macedonia near Florina, flows first south, then northeast and reaches the sea not far from the mouth of the Vardar. In the Epirus the Arta has its sources north of Yanina and rushes in foamy ripples through gorges and woodlands to empty in the gulf to which it has given its name. The Aspropotamo or White River, the Fidaris and Sperchios are the chief rivers of old Greece. The Peloponnesus is spanned by a network of small rivers, all descending from the central hills and running wildly in all directions. The Rouphia which flows westward and empties in the Ionia Sea is the largest river of this part of Greece.

Population. Before the Balkan War in 1912 Greece had an area of 25,000 sq. mi. and a population of a little over 2,500,000. In that year through the acquisition of territories from Turkey in Epirus, Macedonia, Thrace and the island of Crete, as well as other islands in the Aegean, she added greatly to both her area and population. During the last decade great population exchanges between Greece and Turkey and Bulgaria have further increased the number of her inhabitants. In 1923 a treaty was concluded at Lausanne between Greece and Turkey for the compulsory removal from Turkey of all Greek nationals except those residing in the city of Constantinople. As a result of this 1,500,000 Greek refugees from Asia Minor and Eastern Thrace, as well as thousands who voluntarily emigrated from Bulgaria, settled in Greece. According to an estimate made in 1930 the population of Greece was 6,394,000. Individual cities in 1928 had populations as follows: Athens, 452,919; Salonika, 236,524; Patras, 61,278; Kavalla, 49,980; Heraclion, 33,404; Corfu, 32,221; Kalamata, 28,955; Larissa, 23,899. There are thousands of Greeks away from the homeland, the largest number being in the United States, variously estimated at from 400,000 to 500,000.

Religion and Education. The Greek Orthodox Church, to which the majority of the population belongs, is the state religion of Greece. The holy synod at Athens, consisting of six bishops and presided over by the metropolitan of Athens, governs the Greek church, but the highest ecclesiastical authority, the patriarch, still has his headquarters in Constantinople.

Education is free and compulsory for all children between the ages of seven and twelve. There is no strict enforcement of this law, however, especially in less settled communities, and a considerable percentage of the population, of which no exact figures are available, is illiterate. The national school system is under the direct charge of the ministry of education. In 1928 the ministry reported the existence of 8,277 primary schools with 12,552 teachers and 645,353 pupils. Besides the high schools, of which there were 690 with an enrollment of over 100,000 pupils, there were dozens of commercial, agricultural and technical schools and 17 military schools, including those for the training of army and navy officers. The University of Athens provides higher education and is one of the largest and best-equipped in the Balkan Peninsula. There is also a university in Salonika, but the faculty and student body are very small. Various countries, among them Great Britain and the United States, maintain schools of archaeology in Athens for research in Greek art and history.

Production and Industry. Only one-fifth of the total area of Greece is cultivable. Yet Greece is primarily an agricultural state, nearly three-fourths of her population being engaged in the cultivation of the soil, in live stock raising and in related pursuits. Cereals are the chief agricultural products, but are not sufficient to take care of the domestic need. Tobacco, olives, oranges and lemons, wine and currants constitute the staple exports. In 1928 the output in metric tons of cereals and other products of the soil was as follows: wheat, 356,130; barley, 157,767; maize, 128,844; oats, 75,146; tobacco, 58,738; wine, 307,523; currants, 170,690. In the same year Greece produced over 100,000 metric tons of olive oil. The number of animals in the same year included: sheep, 6,920,000; goats, 4,919,000; cattle, 910,000; horses, 220,000.

The mineral deposits are reported to be large and varied, but they are far from fully exploited. Those worked are lignite, iron, copper, zinc, silver, antimony, nickel, lead, manganese, salt and marble. In 1927 the output of iron ore was 17,314 metric tons, of raw magnesite, 105,000 metric tons, and of lead ore, 143,346 metric tons.

Greek industry is still in the embryo stage. Want of adequate coal supply has been the chief obstacle to its development. In recent years the enactment of high tariff walls and the immigration of refugees have made labor cheap and aided its development. The refugees from Asia Minor brought with them the art of carpet weaving. Olive oil, wine, textiles, leather, soap, spirits, confectionery and cigarettes are the chief products of manufacture.

Transportation and Trade. Until 1916 Greece was isolated from the network of European railways. In that year the line from Athens going north through Thessaly was extended to Gida, on the Salonika-Monastir route, and thus for the first time railway communication was established with Europe. This line from Athens to Salonika and the one leaving Athens for the Peloponnesus are the only important railways of Greece, the country being deficient in this mode of transportation. In fact, outside of Albania, which has no railways whatever, Greece has the poorest railway facilities of any Balkan country. The total length of the Greek rail lines in 1928 was 1,991 mi., of which 884 mi. were operated by the state. But Greece is compensated for this lack of rail transportation by her extensive water communications. The activities of the Greek merchant marine extend far beyond the ports of Greece. In 1928 the merchant navy of the Greek state had a total of 729 sailing vessels and 528 steamers with a gross tonnage of over 1,300,000. In the same year 25,000 steamers with a total of 17,000,000 tons entered the ports of the country, the largest of which are Piraeus, which is the port of Athens, Salonika and Patras.

The trade of Greece is chiefly with Great Britain, the United States, Germany and Italy. Currants, olive oil, wine and tobacco are exported in great quantities. The imports include textiles, arms and explosives, metal wares, vehicles, machinery, implements of all kinds and mineral products. The total values of the imports in 1929 amounted to 13,275,531,000 drachmas and the exports to 6,985,196,000 drachmas.

Finance. The monetary unit of Greece is the drachma, normally valued at one gold franc or 20 cents but now worth three-fourths of a cent, or seventy-five drachmas to one American dollar. The National Bank, founded in 1841, issued the currency until 1928 when the privilege was transferred to the Bank of Greece. In that year there were in circulation 5,758,981 drachmas worth of banknotes. In the same year there were in Greece 25 banks with a total of 9,682,000,000 drachmas in deposits and an aggregate capital of 2,159,000,000 drachmas.

Greece has a large public debt and the revenue and financial operations of the state are under the supervision of an international control commission in Athens. A considerable portion of the national revenue is turned over each year to this commission for the payment of interest on foreign debts. In 1927 the payments made by this commission for the service of debts amounted to 1,297,514,056 drachmas. The total public debt of Greece in 1929 was 38,774,000,000 drachmas. The national revenue for 1929-30 was 9,665,613,373 drachmas and the expenditures for the same period were 9,657,613,422, the largest share, nearly one-fourth, going to the payment of interest on debts.

Government. From 1830, after it gained its independence from Turkey, to 1924, Greece was a kingdom. But in April, 1924, the monarchy was overthrown by a national plebiscite and a republic established. The legislative authority is in the hands of a chamber of deputies and a senate, the former consisting of 250 members and the latter of 120. The deputies are elected by popular secret ballot, the senators partly by the people, partly by the chamber in joint session with the senate itself, and partly by corporations and different professions. The head of the government is the president, who holds the executive power and is assisted by a council of ministers presided over by a premier.

For local administration Greece is divided into departments, or *nomarchies,* and counties, or *eparchies,* administered respectively by *nomarchs* and *eparchs.* MACEDONIA is governed by a governor-general with headquarters in Salonika. Juridically the country is divided in a similar manner. There are county and departmental courts and a court of cassation in Athens. X.

ANCIENT HISTORY

Early Greek history is almost entirely a matter of speculation. Archaeologists have uncovered a wealth of material corroborating the picture of life described by Homer. The Trojan War is regarded as a fact, and its date tentatively set in the late 12th century B.C. The Hittite and Egyptian texts refer to a people whom many scholars take to be the Homeric Achaians. How long had these Achaians been in the Balkan

peninsula? What was their relation to the earlier inhabitants of the Aegean lands? Were they newly arrived conquerors, or old settlers who had combined with others to create the brilliant Mycenaean civilization? The answers to these questions must wait upon further additions to historical knowledge.

The four centuries following the Trojan War, although of the greatest importance in the formation of Greek society, are likewise clothed in obscurity. Throughout this period there were vast displacements of population in the Near East. Toward the beginning of the period occurred the last noteworthy migration of Greeks into the Balkan peninsula, the so-called Dorian invasion. The older Mycenaean civilization quickly disintegrated. The use of iron, introduced from the north and east, soon became common. Greek tribes of the mainland pushed steadily across the Aegean, occupying the islands and the western coast of Asia Minor. Beginning in the 8th century and continuing into the 6th century the Greeks sent successive waves of colonization beyond their Aegean homeland. The shores of the Hellespont and the Bosporus were occupied. The Black Sea was encircled. To the west the coast lands of eastern Sicily and southern Italy were settled. Wherever the Greeks went they carried with them their distinguishing political institution, the city-state—small, compact, autonomous. Each colony became a new self-governing nation. The colonists clung tenaciously to their language, religion and social customs.

The creative forces in Greek life can be apprehended clearly for the first time in the 7th and 6th centuries B.C. It was in this period that Greek art began to break away from Oriental influence and to assume the characteristics of native genius. It was in this period that the Greek intellect as a result of philosophy and the scientific method threw off the first sparks destined to illumine for centuries the lands touching the Mediterranean. Out of the social and economic problems of this period grew the rival political systems of Sparta and Athens so admired by posterity.

Political Systems of Sparta and Athens. At Sparta the type of political organization was determined by military necessity. The Spartan state was constantly menaced by hostile neighbors without and rebellious serfs within. As a result the rulers perfected a polity wherein every activity of civic life was directed to the waging of war. Trade and commerce were outlawed for Spartans and given over to resident aliens. Agriculture was carried on by the serfs under compulsion. Harsh as the system was, it served its purpose. From the middle of the 7th century to the second quarter of the 4th century Sparta was the dominant military power in Greece.

The Athenian state developed on an entirely different pattern. The population was homogeneous. Political evolution was a social and domestic problem. Early in the 7th century the tribal kingship yielded to a magisterial board of nine archons. The tendency toward democracy was hastened by intertribal rivalry, by the struggle between the large landowners and the small farmers, and finally by the rise of a wealthy mercantile class. Through the reforms of Solon, 594 B.C., the dictatorship of Pisistratus, 560 B.C., and the constitutional reorganization of Cleisthenes, 508 B.C., Athens passed from aristocracy and tyranny to pure democracy.

Persian Invasion Repulsed. While Sparta was growing stronger as the leading military power in Hellas and Athens was advancing toward democracy the Greek cities of Asia Minor were being subjected to the rule first of their Lydian neighbors to the east and later to the rule of the Persian Empire. Although the Persian yoke was easy the Greeks resented keenly their position as vassal states of an Oriental despotism. In 499 B.C. the Asiatic Greeks rebelled. They appealed to their kinsmen on the mainland for support; but only Athens and Eretria responded. The revolt was suppressed by Darius



COURTESY M. M OF ART

GREEK WARRIOR ATTACKING A PERSIAN
From a red-figured amphora, or two-handled jar, of about 460-420 B.C.

who now realized that his western frontier could be made secure only by the inclusion of all Greeks within the Persian Empire. In 490 B.C. he struck immediately across the Aegean at Eretria and Athens. Eretria fell. The Persians then moved on to Attica by sea. The Athenians, reinforced only by a small band of Plataeans, met the Persians at Marathon and won a victory justly regarded as decisive in the course of European civilization. It was 10 years before Persia resumed her plans of conquest. The salvation of Greece was the work of Themistocles the Athenian who had with great difficulty induced his people to build a powerful fleet. He knew that the issue with Persia would be settled at sea. It was settled at the Battle of Salamis, 480 B.C., as Xerxes beheld the destruction of his fleet. The following year the Greeks under Spartan leadership broke the land power of Persia at the Battle of Plataea. The repulse of Persia assured for centuries the free and independent development of European civilization.

The immediate effect of the Persian War was that Athens attained the pinnacle of her political and spiritual greatness. Politically, she became the first power in Greece; spiritually, as reflected in her tragic poets, her sculptors, her architects, and her philos-

ophers of the age, she became the first power of the Mediterranean. She was forced later to yield her political position; but posterity never challenged her spiritual supremacy.

Conquest by Macedon. Under Athenian leadership a league of Greek cities, formerly under Persian rule, was formed to preserve their freedom. The center of the confederacy was the sacred island of Delos. In 454 B.C. the capital was moved to Athens and the league became virtually an Athenian empire. The new imperialism was carried forward by Pericles and actively supported by the radical democracy and the newly rich merchants of Athens, but it inevitably provoked the jealousy and finally the open hostility of Sparta and Corinth. Sparta was loath to surrender her dominant position, and Corinth feared commercial ruin. In 431 B.C. the resentment broke into war between Athens and her dependent allies on one hand and Corinth and the Peloponnesian powers led by Sparta on the other. The war lasted for more than a quarter of a century. It resulted in the prostration of Athens, the loss of her empire, and the exhaustion and demoralization of all the participants. Sparta attempted to play the rôle of dictator in Greek affairs only to fall before a coalition led by Thebes. Thebes for an uneasy hour held the hegemony; but the future lay with a power newly arrived on the Greek scene. Philip of Macedon had taken advantage of the political anarchy of the 4th century to strengthen his hold on the northern Aegean coast lands and with the overthrow of Thebes intervened as the master of Greece. His pretensions were vainly opposed by Athens influenced by Demosthenes and by Thebes. At the Battle of Chaeronea, 338 B.C., Philip defeated the army of patriots and forcibly brought the greater part of Greece into an alliance with the Macedonian crown. He now undertook his long cherished plan of an expedition against Persia, but before setting out he was assassinated. He was succeeded by his young son, Alexander, whose career marks a new age in the history of the world.

Alexander at the head of a Graeco-Macedonian army swept through Asia Minor, Syria, Egypt, Mesopotamia, and the Iranian country as far as India. In two decisive battles, Issus, 333 B.C., and Gaugamela, 331 B.C., he defeated the reigning Persian king and brought the whole of the empire under his control. Death overtook him at the age of 33 before he had time to organize the greatest empire ever won by the sword of a single conqueror. He was the first European to impose western domination on the Orient. As an apostle of Hellenism he made Greek civilization the one classical civilization of the Mediterranean basin.

Roman Conquest. No successor of Alexander was able to hold this vast empire together. Gradually three separate powers emerged to divide the field: the PTOLEMIES in Egypt, the SELEUCIDS in Asia, and the ANTIGONIDS in the Balkans. The deadly wars waged to preserve the balance of power in the East prepared the way for the intervention of Rome, lately victorious over Carthage, 201 B.C. Macedon had given succor to Hannibal and her Greek subjects, and her Seleucid and Ptolemaic rivals rejoiced when a Roman punitive expedition proved successful. In 196 B.C. the Roman commander, Flaminius, proclaimed freedom for the Greek subjects of Macedon; but this freedom in time meant only the freedom to take orders from the Roman Senate. After the destruction of Antigonid and Seleucid autonomy Greek resistance to Roman hegemony was met by the destruction of Corinth, 146 B.C. Greece thereafter became subject to the Roman governor of Macedon. The last effort to preserve the political integrity of the Greek East was undertaken by Cleopatra with the support of Mark Antony. This plan collapsed at the Battle of Actium, 31 B.C. The Ptolemaic kingdom became the private estate of the Roman emperor, and mainland Greece was organized as a Roman province. Not until the rise of Constantinople in the 4th century A.D. did the center of political gravity shift again to the East. (*See* BYZANTIUM.)

Of course, no chronicle of political events adequately describes the influence of Greece in classical antiquity. That influence was pre-eminently intellectual and cultural. From the time of Alexander the Great to the sectional division of the Roman Empire Greek was the common language of civilized men throughout Europe and the Near East. Greek literature, Greek philosophy and Greek art persisted as the common expression of the human spirit. The Greek idea of the city-state was preserved in the organization of the Roman Empire which in effect was a federation of city-states. Many features of Roman imperial administration were adaptations of Ptolemaic and Seleucid practices. Christianity was first propagated in the Greek tongue, its holy scriptures first written in the Greek vernacular, and its systematic theology patterned after Greek modes of thought. And much that is most vital in modern western civilization derived from the rebirth of Greek ideas in 15th century Europe. S. T.

BIBLIOGRAPHY.—G. Grote, *History of Greece,* 1884; G. W. Botsford, *Hellenic History,* 1922; J. B. Bury, *History of Greece to the Death of Alexander,* 1922; M. I. Rostovtzeff, *History of the Ancient World,* vol. 1, 1926.

MODERN HISTORY

Before the fall of Constantinople in 1453 Mohammed II, ruler of the Ottoman Turks, had ravaged the Greek coasts, and his father, Amurath II, had subjected many Greek cities, Corinth among them. After 1453 Mohammed II conquered most of Greece, opposed with any success only by the Venetians, who had been for some time contesting the mastery of the Mediterranean. The Turks divided the country into pashalics, and set over them despotic pashas, beys and agas. Under their rule Greek history was particularly dark, mainly because of the lack of nationalism. The Turks quickly subjugated the people, abolished the Frankish duchy of Athens, and converted

the Parthenon into a mosque; they took Euboea and the Cyclades and, finally, the island of Crete. Their rule was broken for short periods by the victories of the Italian-Spanish fleet at Lepanto in 1571 and the successes of the Venetians in the Peloponnesus in 1687. But in 1718 the Turks had regained all Greece, and retained it until 1821.

During the period of the Moslem domination the Greeks as a nation were practically effaced. They were subjected to the barbarities of both the Turk and the Latin Christian, and the population was seriously decreased by the massacre of men and the transference of women and children to harems and slave markets. Many of them took refuge in Italy.

Struggle for Independence. Coinciding with the spirit of freedom from oppression which had spread through Europe, the Greek desire for independence began to flame at the beginning of the 19th century. Secret societies and the Hetaeria Philike, founded in 1814, began to foment rebellion, and were aided by the machinations of Russia, who secretly wished to annex Greece. In 1821 Prince Alexander Ypsilanti, a Russian officer, led a rebellion in Moldavia, and simultaneously a revolt broke out in the Peloponnesus. These two outbreaks began the War of Independence, which lasted from 1821 to 1829. In the first year of the war the Greeks met with great success, being victorious on land and sea. They were aided by naval forces from the Aegean islands, and were excited to frenzy by the brutal massacres encouraged by the Turks. At the end of the year the Greeks declared their independence and set up a constitutional government under Alexander Mavrokordatos. In the next year occurred the atrocious massacre at Chios in which the Turks slew 30,000 Greeks and took 50,000 women and children for sale in the slave markets. In 1825 Corinth and Athens were captured by the Moslems, and in 1826 Missolonghi. But at this point England and Russia decided to interfere, joined soon by France. The fleets of the three countries anchored at Navarino to check any further inroads of the Turkish and Egyptian navies, for the Sultan would not agree to make peace. By an accidental shot from a Turkish ship a naval battle was precipitated, and the Turko-Egyptian fleet was utterly destroyed on Oct. 20, 1827. The next two years saw the outbreak of the Russo-Turkish War and the defeat of the Turkish forces in the Peloponnesus. In Sept. 1829 Turkey recognized the independence of Greece. Three years later the Great Powers declared Greece a kingdom under the guarantee of Great Britain, France and Russia. Prince Otho of Bavaria was chosen as first king of the new Greece. From 1843, when a constitution was formulated, until 1863 the country was governed as a constitutional monarchy. In that year the government declared Otho no longer king and elected Prince George of Denmark as King George I. At this time England ceded the Ionian Islands to Greece.

In the period 1863-1922 Greece attempted to win from Turkey some of the possessions lost in the era of Moslem supremacy. In 1881 Turkey surrendered Arta in Epirus and the greater portion of Thessaly. Although the Cretan Greeks rebelled against Turkey in 1896, Crete was not recovered until 1912, when the treaty at the end of the First Balkan War gave Greece much territory in Macedonia, Epirus, Thrace and the Aegean islands. Although some of the territories in Macedonia and Thrace had been assigned to Bulgaria by the Balkan League, Greece refused to concede her claims, and thus embroiled herself in the Second Balkan War in 1913. By the treaty of Bucharest Greece was allowed to retain the disputed regions.

Greco-Turkish War, 1921-22. The World War found Greece undecided between the Allies and the Central Powers, although Venizelos, the premier, declared a position of neutrality. King Constantine was asked to abdicate in June, 1917, by the Allied Powers, and Venizelos declared war on the Central Powers on June 29. At the Paris Peace Conference Greece became a favorite, and, backed by England, she obtained, besides territory in eastern Thrace, the city of Smyrna and its hinterland in Asia Minor where lived more than 1,000,000 Greeks. But in taking possession of the new territory the Greeks pushed the Turks far into the interior. In the summer of 1922, however, the Turks, receiving secret European aid, awoke to action under Kemal Pasha. Shaken by internal treason and a long stay under arms, the Greek army retreated to Smyrna and were thence transshipped to Greece. Immediately upon entry of the Turkish army into the city, Smyrna was set on fire by the Turks, Sept. 14, 1922. A frantic exodus of Christians resulted, augmented by refugees from the hinterland. These were taken away by neutral vessels and scattered throughout Greece. There the disposition of 1,000,000 refugees became one of the most difficult problems of the country.

King Constantine returned in 1920, but was forced to abdicate in 1922, and his son George II became king. He ruled until Dec., 1923, when he was forced to leave Greece also. By a national plebiscite the monarchy was overthrown on Apr. 13, 1924, and Greece was proclaimed a republic.

Political unrest marked the first years of the new republic. Gen. Pangalos, who forced the resignation of Premier Micalakopoulos in June, 1925, and set himself up first as premier and then as dictator, was overthrown in August, 1926, and constitutional government was restored. In November Alexander Zaimis was elected premier and continued in office until Venizelos again became premier on July 3, 1928. Venizelos has succeeded in bringing peace to Greece and in improving her foreign relations. In the summer of 1932, due to continued criticism by the Royalist party, he offered his resignation to President Zaimis, but it was refused.

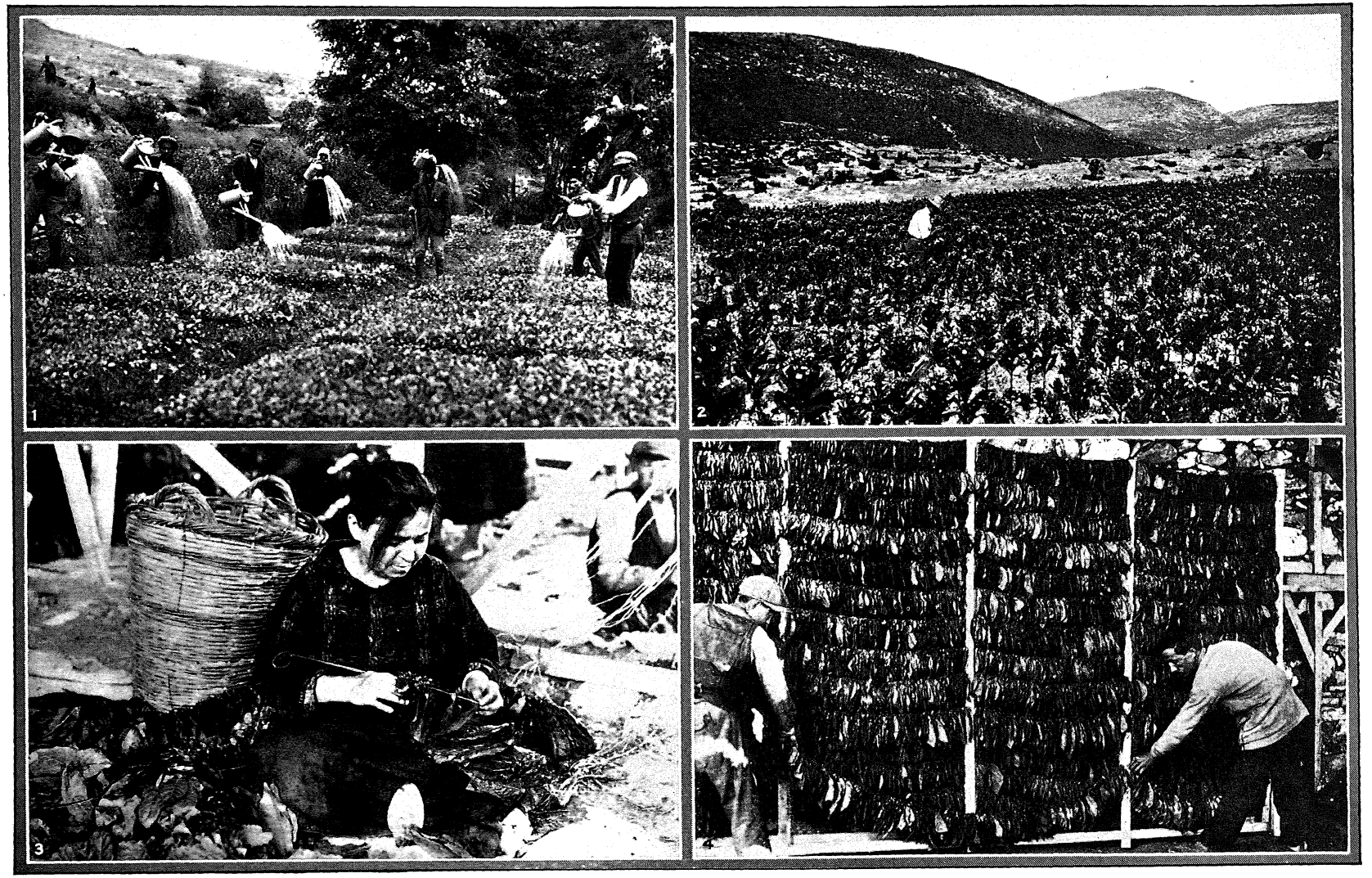
GREEK ARCHITECTURE. A period of less than 1000 years is covered by Greek architecture and its Hellenistic derivative. Keeping the resilience of the Minoan art on which it was founded, it took ideas and discipline from Egypt on one hand, and from



NOMLAS PHOTOS, COURTESY HELLENIC INFORMATION BUREAU

RURAL VIEWS IN PRESENT-DAY GREECE

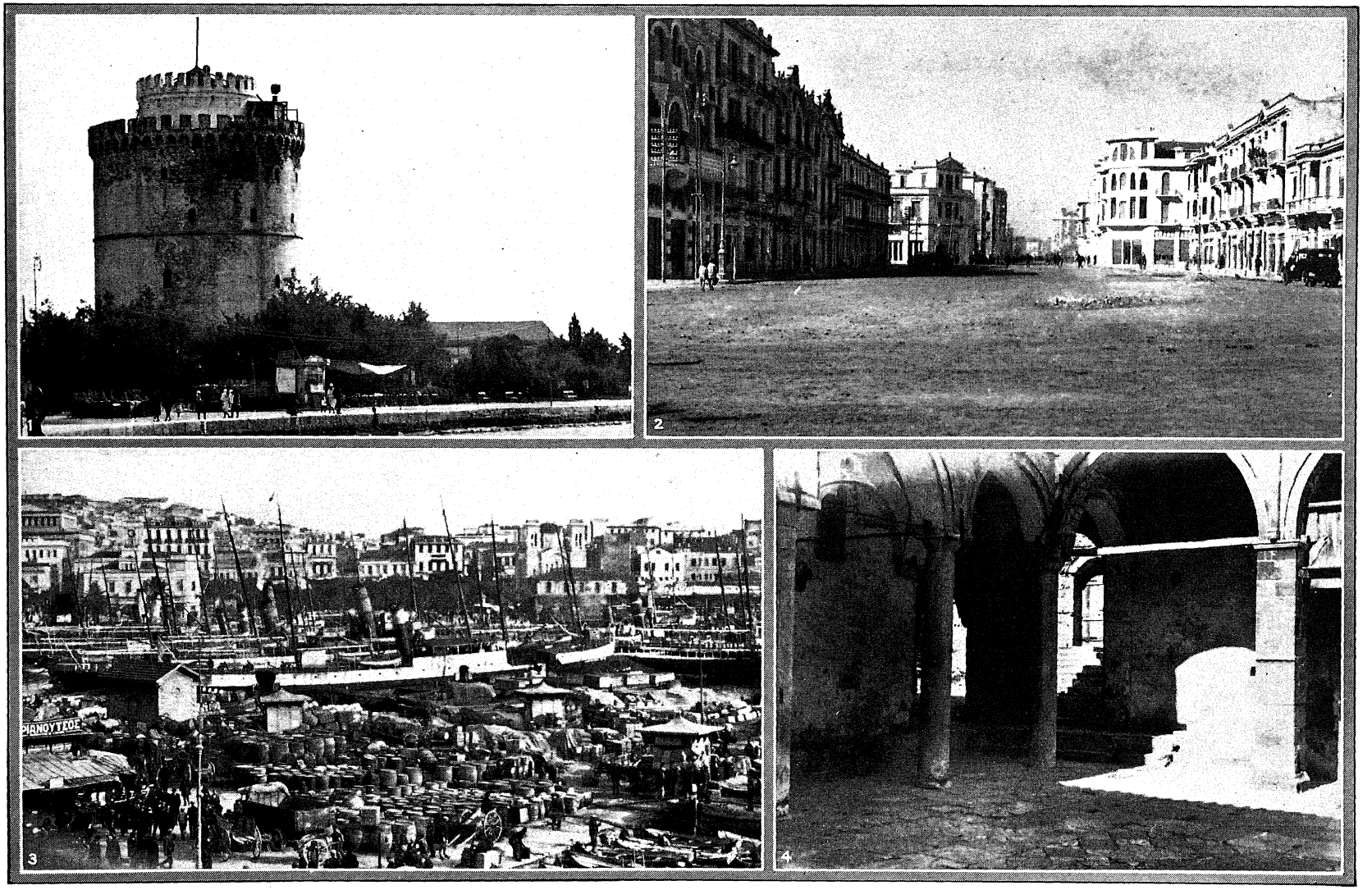
1. Shepherds in the uplands of Greek Macedonia. **2.** Monastery of the Greek Orthodox Church near the village of Serres. **3.** Peasant village outside the village of Serres, Macedonia. Storks' nests in tree. **4.** Vineyards in Nemea, near Corinth, once the site of the Nemean games.



NOMLAS PHOTOS, COURTESY HELLENIC INFORMATION BUREAU

THE TOBACCO INDUSTRY IN MACEDONIA, NORTHERN GREECE

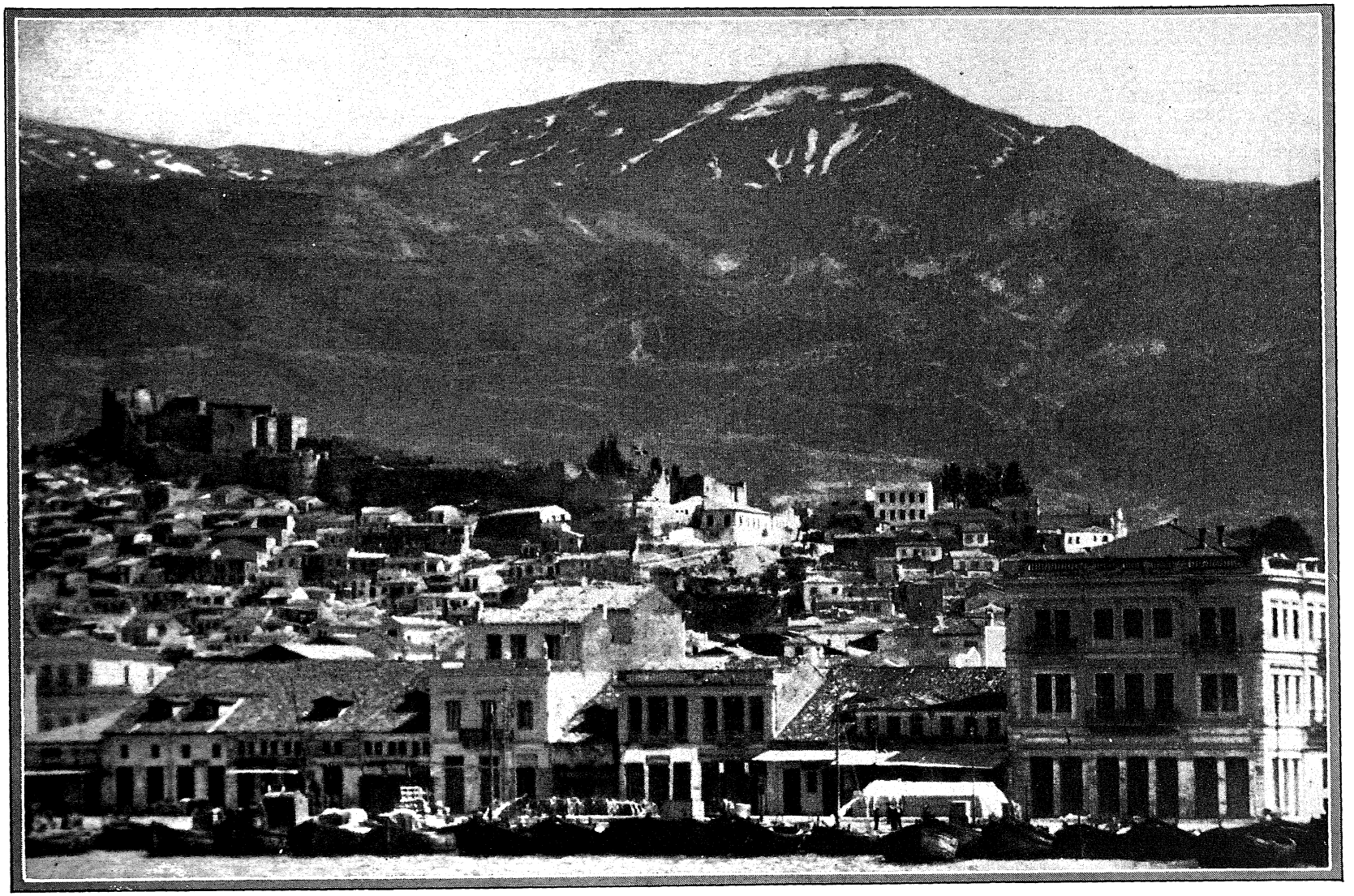
1. Macedonian peasants watering tobacco plants in early stages of growth. **2.** A Greek tobacco planter "topping" the plants to increase development. **3.** Peasant woman threading tobacco leaves preparatory to curing. **4.** Sun-curing tobacco. The tobacco leaves are dried out-of-doors.



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CITIES AND TOWNS IN GREECE

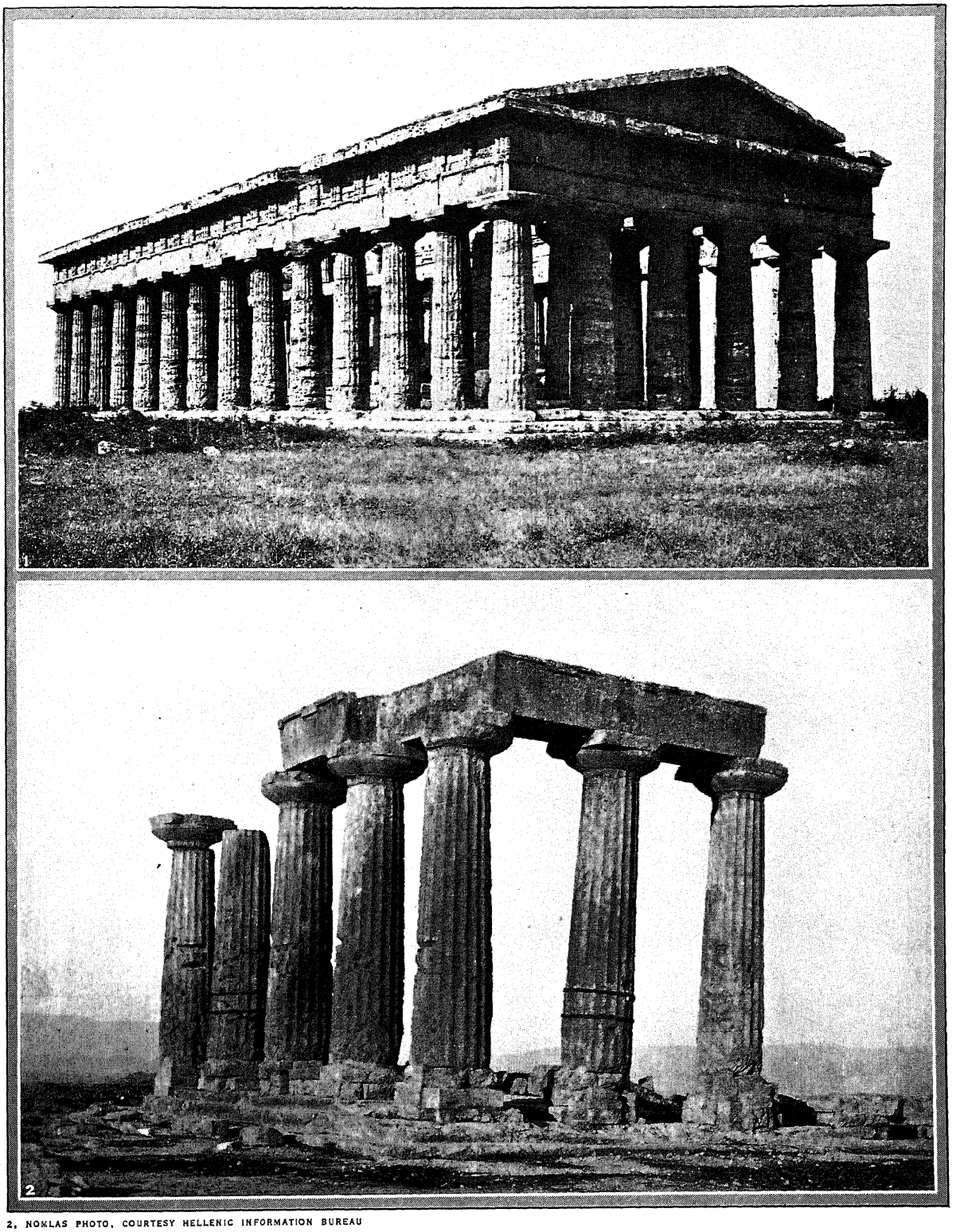
1. The massive White Tower at Salonika, capital of Greek Macedonia. **2.** A street scene in Salonika, showing a modern quarter of the port. **3.** Harbor view of Piraeus, in Attica, the port of Athens. **4.** The old Peribleptos Church at Mistra, fortress town near Sparta.



NOMLAS PHOTO, COURTESY HELLENIC INFORMATION BUREAU

THE GREEK SEAPORT OF PATRAS

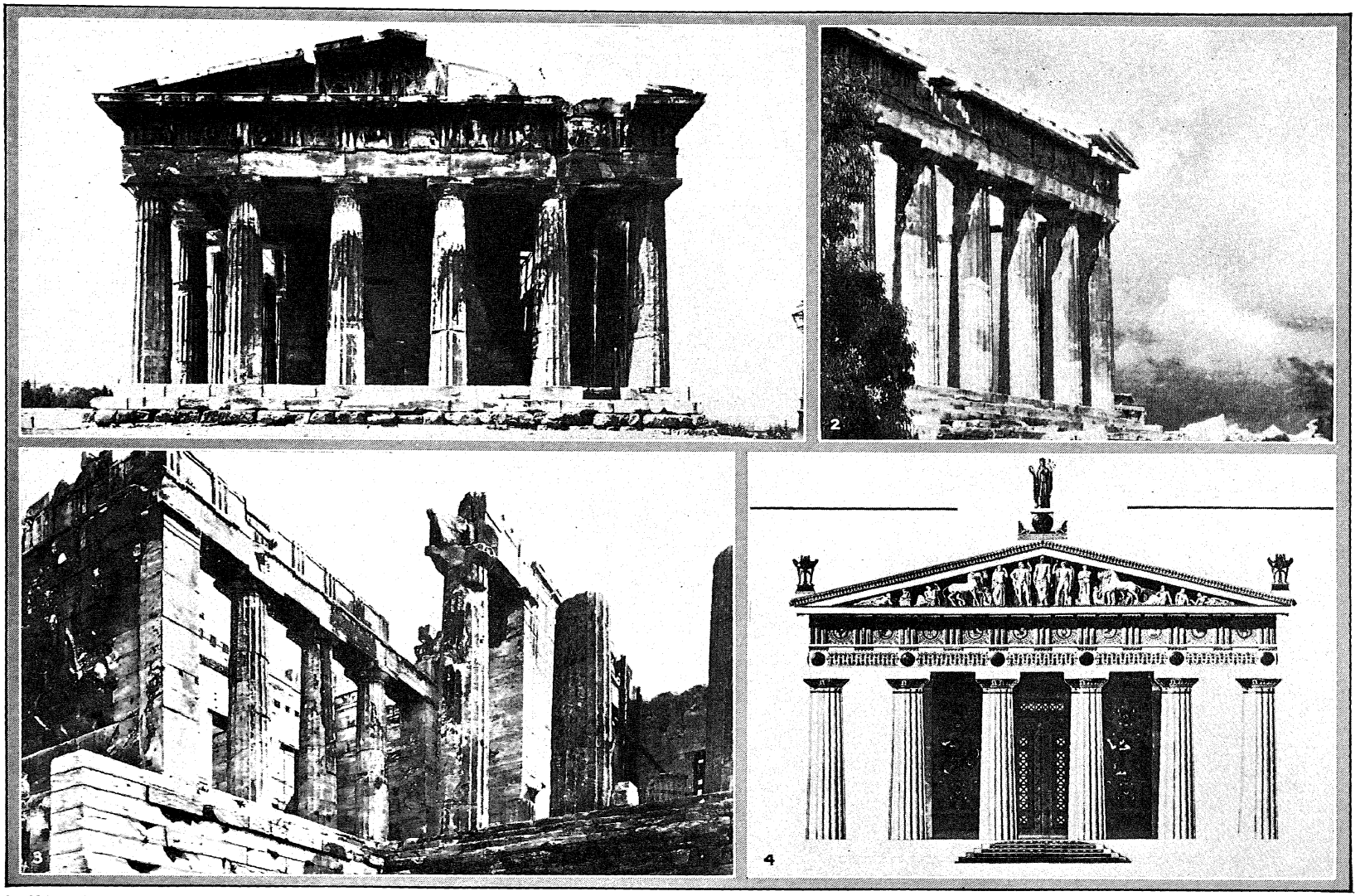
A view of Patras, principal seaport on the west coast of Greece. In the left background is the medieval castle, constructed on the site of the ancient acropolis.



2, NOKLAS PHOTO, COURTESY HELLENIC INFORMATION BUREAU

ARCHAIC TEMPLES OF ANCIENT GREEK CITIES

1. So-called Temple of Neptune at Paestum, supported by fluted Doric columns, an example of early Greek architecture surviving from the beginning of the 5th century B.C. **2.** Seven monolithic Doric columns of the Temple of Apollo at Corinth. 7th-6th centuries B.C.

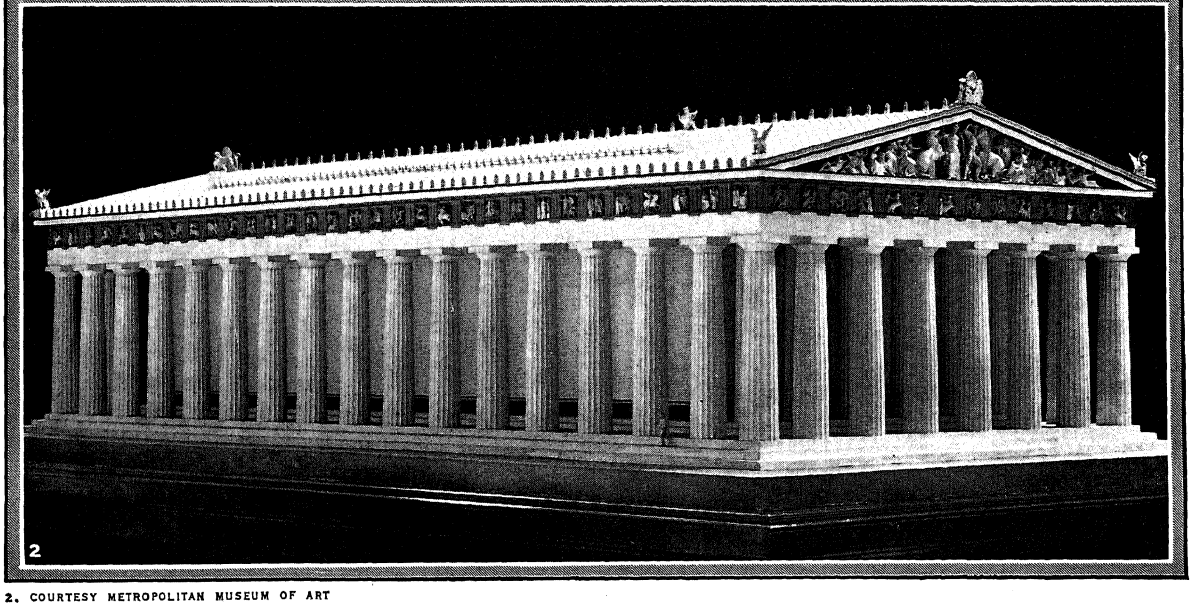


2, COURTESY HELLENIC INFORMATION BUREAU; 4, FROM VICTOR LALOUX AND PAUL MONCEAUX, RESTAURATION D'OLYMPIE, MAISON QUANTIN, 1889

HELLENIC GREEK ARCHITECTURE: TEMPLES AND SECULAR BUILDINGS

1. The Theseum, the hexastyle temple to the northwest of the Acropolis. 2. The front of the Parthenon. 3. Ruins of the Propylea, the entrance to the Acropolis. 4. Restoration of the east façade of the Temple at Olympia, Greece.





2. COURTESY METROPOLITAN MUSEUM OF ART

THE GLORY THAT WAS GREECE: THE PARTHENON

1. Despite the depredations of time, the explosion of 1687, and the removal of the Elgin Marbles, the Parthenon still stands as the greatest monument of Greek architecture.
2. Restoration showing the left side and front of the temple as it was in 438 B.C. when dedicated to Athena, the tutelar deity of the ancient city. Ictinos was the architect.



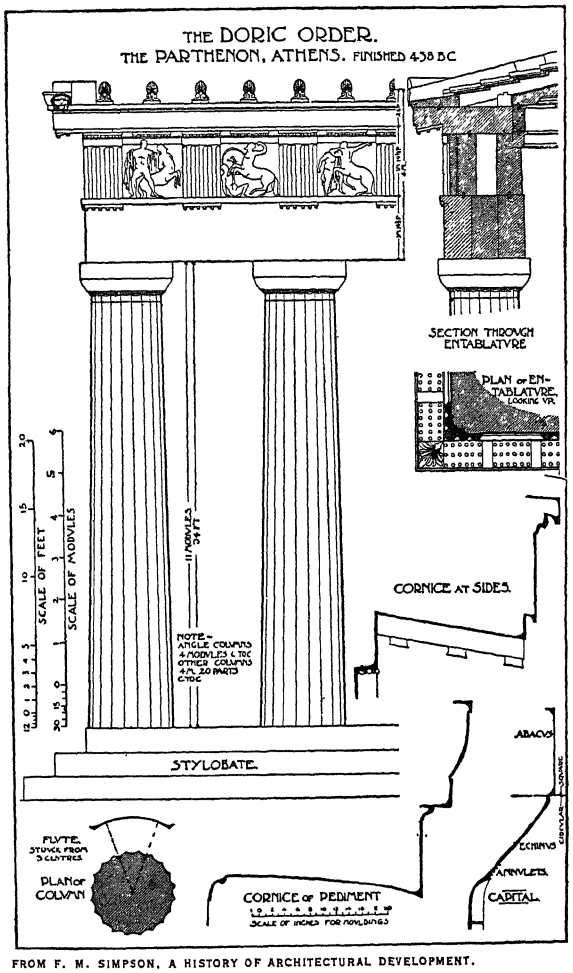
2. COURTESY HELLENIC INFORMATION BUREAU; 3, 4, PHOTOS BY GARDNER WELLS, FROM R. I. NESMITH AND ASSOCIATES

GREEK TEMPLES AND SECULAR BUILDINGS

1. Façade of the Treasury of Cnidos at Delphi, a restoration in the Delphi Museum. **2.** Small Ionic-columned Temple of Athena Niké (Niké Apteros) on the Acropolis, Athens. **3.** Side view of the caryatid columns of the Erechtheum, Athens: The Porch of Maidens. **4.** Ruins of the Erechtheum on the Acropolis, with the Porch of Maidens at the right.

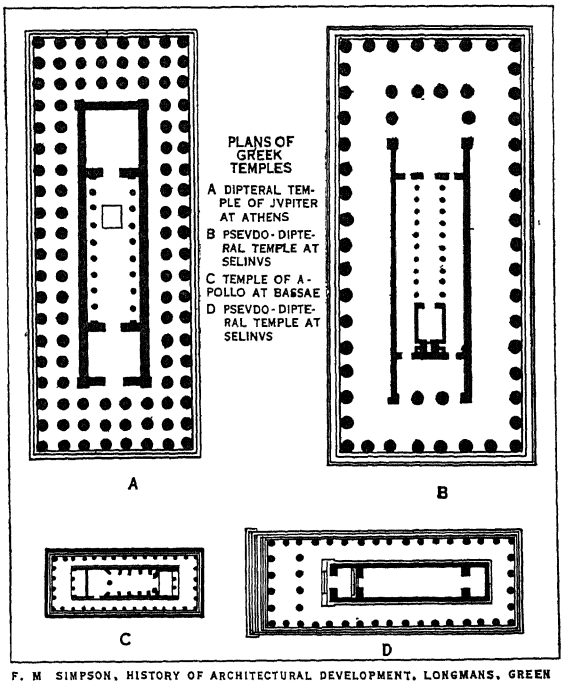
Asia on the other, molding them and making them Hellenic by its own genius. Early Greek architecture had a long struggle to attain perfection in a single monumental form, the temple, and its achievement in the Parthenon at Athens. It made too great an effort to give splendid monumental expression to the buildings, long very simple, which housed civic activities, as well as to lay down the lines of civic architecture on a comprehensive scale. The first phase was the more Greek, and its climax was their triumph; the second was a part of the process by which Greek culture became an essential part of Mediterranean culture and so of our own. The Greek contribution to monumental civic architecture was the beginning of a new tradition which later culture has continued and enlarged.

Important Periods. The dating of Greek monuments is precise or very nearly approximate, and the periods well distinguished from one another: *c. 1100-850* B.C., the Greek Dark Ages, during which the classic Greek race was formed and its art given a definite national cast. Egyptian influences were important to the vigorous Dorians, who occupied the mainland of Greece and colonized Magna Graecia, while Oriental influence played upon the less austere Ionians, who occupied western Anatolia and many of the Aegean isles. *c. 850-480* B.C., the Archaic Period, marked by a consistent improvement in building methods, technical skill and esthetic achievement. The types of building remained simple, the problem being good proportion, improved decoration, and above all the perfection of the two orders, Doric and Ionic. Local centers were important. A first wave of Asiatic feeling was registered. *480-400* B.C., the Great Period, when, after a struggle for national independence, Greek power was focussed in Athens, where the culmination took place and the fusion of the two architectural traditions began. Comprehensive schemes of city planning and embellishment were undertaken as well as remarkable single buildings. *400-323* B.C., the Later Fruition in Greece; the Ionian Renaissance, which produced splendid, original and richly decorated structures in Anatolia. It was marked by the invention and use of the Corinthian order, a variant of old Ionic themes. Preeminence passed to Asia Minor. *323-146* B.C., the Hellenistic Period which saw the building of many civic projects, the development of monumental planning, the second infiltration of Asiatic taste, the expression of florid or Baroque spirit in Greek art and its expansion far beyond Greek borders.



FROM F. M. SIMPSON, A HISTORY OF ARCHITECTURAL DEVELOPMENT. LONGMANS, GREEN & CO.

Types of Building. *Temples.* Most important of the buildings was the temple, which was conceived as a house for the divinity. It early took the form of the *megaron,* or principal hall of the Mycenaean house. It almost invariably faced the east. The *naos,* or cella, regularly sheltered an image of the god, made of wood, terra cotta or stone in the archaic period; or marble, or ivory and gold on a wooden framework in



F. M. SIMPSON, HISTORY OF ARCHITECTURAL DEVELOPMENT, LONGMANS, GREEN

TEMPLE PLANS

later times. In archaic examples the cella, if large, was occasionally divided by a central range of columns supporting the roof; in later work superposed columns and galleries at the sides were used, leaving the center free. Particularly in Dorian colonial and Ionian Renaissance work a sanctuary chamber occurred, behind the *naos* and accessible from it. Very often a rear porch (*epinaos, opisthodomos*) and sometimes treasury chambers, appeared beyond the *naos,* but not directly accessible from it.

Between the cella and the vestibule was a great entrance door, generally the sole source of light for the sanctuary. Usually the vestibule, or *pronaos,* was bounded north and south by extensions of the cella walls, called *antae,* and fronted by a line of columns forming a portico. If the columns are set between the end walls, they are said to be in antis. If this arrangement is repeated at the back, the building is said to be a double templum in antis, and the number of columns is given, distyle for two, tristyle for three, and tetrastyle for four. If the columns of the portico extend entirely across the temple building, it is said to be prostyle, and if they extend across the rear, as well, the temple building is said to be amphiprostyle. The archaic temple buildings are longer and narrower in proportion than the fully developed examples.

The typical developed temples have in addition a peristyle or enclosing range of columns. With the rarest exceptions, these columns stand free, usually set at the distance of about one intercolumniation from the cella wall. If there is a wide *pteroma,* or passage, with the columns set two intercolumniations from the wall, the temple is said to be pseudo-dipteral. A dipteral temple has two complete encircling lines of columns. Beneath the colonnade is the stereobate, consisting of a leveling course and three steps which vary with the size of the column; blocks are inserted to make practical steps if needed. Above the colonnade comes the entablature consisting of the epistyle, or architrave (lintel course) frieze, or decorative course, and cornice or overhanging roof-end. The triangular space under the roof at each end of the building is called the pediment; in this the plain central tympanum often serves as a background for decorative statuary supported on the horizontal cornice. The temple roofs were invariably supported by heavy timbering, not truss-work. They were covered with wide flat tile, sometimes of marble, the joints being protected by smaller pitched top tile called cover-tile. This form was almost universal until about 450 B.C. when the sculptor Polyclitus the Younger built, at Epidauros, the first *tholos,* or round temple. This type proved very popular and continued in use beside the older form. For the mystery cults the Greeks required an assembly hall rather than a temple. Greek temples were regularly set within sacred enclosures, or *temenoi,* which were often provided with monumental entrances, called *propylaea.* The altars, often large, stood clear of the temple and in front of it. Here, rather than in the temple, the rites of worship were performed; but visitors were admitted to the temples.

Treasuries. The simple distyle-in-antis temple form was adopted for the treasuries in which the Greeks kept votive offerings and trophies at their great sacred centers, such as Olympia and Delphi.

Theaters. The Greek theater originated in cult dancing, and Greek theaters employed the orchestra circle where the action took place; they were always built against hillsides. The seats, built of stone or marble from the 4th century onward, were concentric with the orchestra and swept more than half way around it, intersected by radial and horizontal passages. The front of the stage building was arranged to accommodate scene panels; its top, already used in Greek times, became the stage at a later period. To either side between the ends of the seats and the stage building was a large passage, called the *parados,* for the entrance and exit of spectators. The acoustic properties of Greek theaters are often very remarkable; this is the case at Epidauros, a fine 4th century example. The famous Theater of Dionysos in Athens has no longer its old Greek form, but it contains beautiful marble monumental seats and altar.

Halls of Assembly. The long apsidal bouleuteria, or council houses, at Olympia, 5th century, reflect an obsolete form, based on the primitive *megaron.* More typical halls of assembly were roughly square, with flat timber roofs, supported on wooden posts or stone columns. Occasionally monitors were raised on the roofs to light the central space. The walls were of stone and had lines of seats ranged parallel to them. The Odeon of Pericles at Athens and the Temple of the Mysteries at Eleusis, 5th century, are typical. A variant is found in the Thersilion of Megalopolis, a parliament hall capable of holding 10,000 persons, built in the 4th century. Considerable ingenuity was shown in arranging the supports radially to increase visibility, but no new exterior expression was achieved; a temple front, pediment and all, was simply applied to one side of the building. At Miletus in Ionia, 2nd century, the bouleuterion had curved rows of seats in an oblong hall, the exterior of which was treated to resemble a temple. The hall had a monumental approach through a propylaeon and a colonnaded courtyard, and is a good example of rudimentary monumental ensemble planning.

Market Places. Much of the life of the Greek cities was focussed on the market place, or *agora.* Articles for sale were set forth in the open space or in cubicles arranged at the back of the outer passage, often a *stoa.* These *stoas* were spacious pillared aisles, frequently double and two stories high. Simple colonnaded fronts were turned toward the market place; the interior supports were as widely spaced as possible; the back was closed by a wall or by shops. The roof and the upper floor were invariably of timber. At Athens a beautiful *agora* gateway still exists.

Athletic Buildings. In Greek times these were not very elaborate. Important centers would have a stadion, a 600-foot track for foot-racing surrounded by stone seats, in plan like a hairpin; a gymnasium, a series of rooms for athletic exercises ranged along the

four sides of a porticoed square court; a guest-house, simple accommodations in cubicles arranged about a court or courts with porticoes, and perhaps a council house and a theater, as well.

Bathing Establishments. These were often a part of the gymnasia and were relatively small and simple.

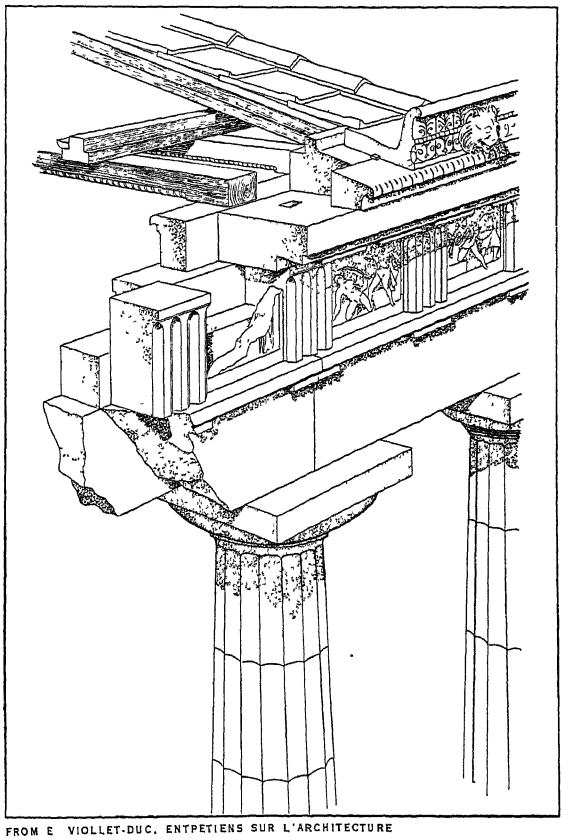
Greek Military Architecture. This type of architecture was a practical art. No striking monumental gateway has survived. Cut stone was used for city walls (Messene, Rhamnous); but sometimes the upper portions were carried out in sun-dried brick, as at Athens. The arsenal at Piraeus, 5th century B.C., is known to have been a large open hall with an aisle and gallery on two sides. The walls were of stone, and the framing was of timber.

Houses. In early times the Greek house was very simple. Its essential element was the hall, *megaron* or *oecus,* a rectangular or apsidal room usually provided with a vestibule and a hearth, and covered by a sloping roof brought to a ridge. Adjoining this were the lesser apartments, simple cubicles in most cases. All of these rooms were set informally about a courtyard, where the life of the house centered. In the later periods charming peristylar courts, planted as gardens, characterized the houses of the well-to-do. The exteriors, set wall to wall on narrow streets, had few openings and were otherwise plain. Many, in all periods, were simply built of sun-dried brick and timber; but in the later periods houses of considerable pretensions were built for magnates. In the royal palace of Maussolos, King of Caria, 377-353 B.C., marble incrustations were used, but no purely Greek palace is known which approached the elaboration of the great Minoan palaces.

Commemorative Monuments. Often these took the form of *stelae,* decorative reliefs, *exedrae* and pyramids of various kinds. The Mausoleion of Halikarnassos, 4th century, is of exceptional size and importance.

Group planning among the Greeks remained entirely informal until late. A monumental quality was from early times given to temple enclosures and certain courtyards and squares through the use of pillared gateways, called *propylaea.* Monumental as the Athenian acropolis and similar groups are, they are not in the slightest degree regular or symmetrical. But from the middle of the 5th century there is a constantly increasing emphasis on symmetry and regularity, and a growing appreciation of axial planning, not only of the elements of a single ensemble, but of two or more buildings together. Geometrical layouts were made for whole cities, notably the Piraeus, Priene and Alexandria. Greek essays in this direction, however, were timid and uncertain as compared to later achievements.

Materials and Structure. A large proportion of all Greek buildings were constructed in sun-dried brick and timber. Stone was used, as in Mesopotamia, to protect the bases of the walls. Peristyles were devised to protect the walls, and it is probable that the design of these porticoes, carried out in wood with terra cotta decorations, quite definitely forecast the definitive design of the Doric and Ionic orders. By 600 B.C. the use of rough limestone, called *poros,* brought to a definite surface by stucco coatings and painted, was common. Marble, used at first for details, was used as ashlar masonry for entire temples soon after the middle of the 5th century, and by that time the use of good material for civic structures was well established; but sun-dried brick is used to this day for minor constructions in Greek lands. Bronze was used for doors, grilles and decorative features. There is good evidence that iron bars were used in exceptional cases to take severe loads off stone members, as the Temple of Zeus, Agrigentum and the Propylaea, Athens. Iron and bronze cramps to bind the stones together occurred in the best masonry, which was laid up without mortar. Colored marble paneling and mosaic were occasionally used during the late period in interiors. Down to the final period Greek architecture, like the Egyptian, consistently used post and lintel construction. A few arches in cut stone, as found at Pergamon, and an exceptional tomb, vaulted in concrete, at Corinth, resulted from Asiatic influence in the latest periods. All other coverings in Greek architecture depended on corbel vaulting, slabs



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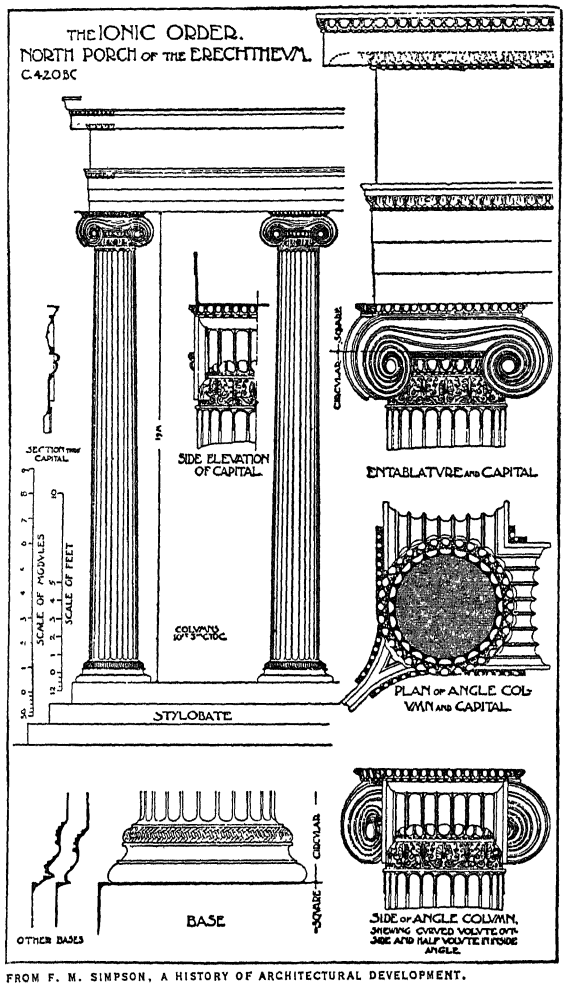
DETAIL OF THE DORIC ORDER

or timbering. The Greeks apparently did not know the truss.

The execution in Greek architecture was normally very careful, and the best of it almost unparalleled.

The whole group on the Athenian acropolis was built of the finest of statuary marbles, and all of the finished parts had the loveliest of surfaces. The best Greek buildings were laid out with uncommon accuracy; but in order to avoid the dry effect of engineering precision, subtle curves were introduced into the main lines, and a slight inclination was sometimes given to the columns and certain plane surfaces of the design. These refinements, as the Nashville replica of the Parthenon shows, were perfectly appreciable in the completed building, and were not merely optical corrections designed to trick the eye. The same is true of the delicate swell, or *entasis,* which usually occurs in the tapering column shafts.

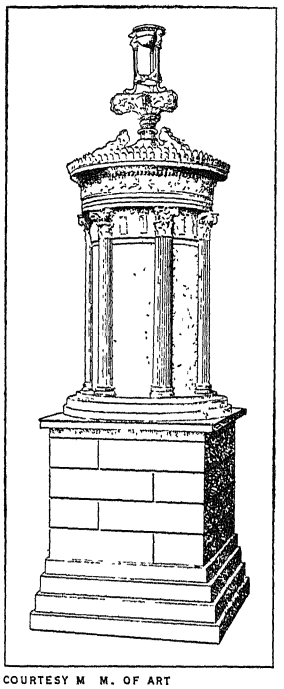
Development of the Orders. During the first phase of Greek architecture the design of the column and its superstructure was a definite problem. The orders, quite distinct at first in design and proportion,



FROM F. M. SIMPSON, A HISTORY OF ARCHITECTURAL DEVELOPMENT. LONGMANS, GREEN & CO.

tended to borrow features from one another, and to approach one another in proportion. All were normally executed in stone.

The Doric order consists of a stepped stereobate, serving as a basis for a heavy fluted shaft, probably suggested by Egyptian "proto-Doric" columns (Der-el-Bahri) surmounted by the *echinus,* a round, cushion shaped transitional member, which, with its necking and *abacus,* were probably suggested by Mycenaean prototypes. The design of the entablature above was probably suggested by wooden construction; but the membering of the frieze and cornice was not a translation of wooden structure. Probably the design of the whole order was more or less fixed by the architect of one of the early temples in stone, now lost to us. Later architects applied themselves to adjusting the proportions until the overweighted order of archaic times became the supreme combination of robustness and grace which the Great Period knew. Afterward the members became progressively more slender and dry. The late examples have the frieze cut on the spanning stones, and the column has a base of its own. The normal number of flutes is 20, but 16 and 24 occur in early work. In the latest examples the channels of the lowest third of the column are sometimes left uncut.



COURTESY M. M. OF ART

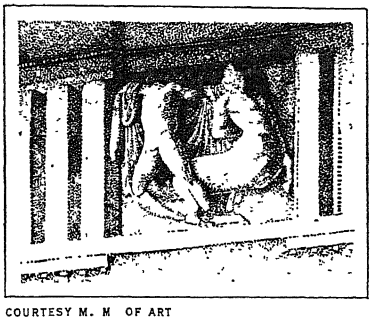
LYSICRATES MONUMENT

Choragic temple at Athens, one of the earliest examples of the use of Corinthian columns, surviving from about 330 B.C.

The Ionic order consists, like the Doric, of stepped base, column and entablature. The column has a round or polygonal base of its own. The flutes of the shaft, very numerous in early examples, number 24 on the typical column. The capital has, like the Doric, an *echinus* and an *abacus,* with the very characteristic Ionic scroll introduced between them. The architrave and cornice of the order are obviously suggested by wooden construction; but the frieze which occurs between them is an old motive derived from Mesopotamia and Anatolia. It had a long and interesting history in Greek art. Archaic examples of the Ionic order have slender proportions, like wooden construction. The order becomes progressively more sturdy, and in the end is but little slenderer than the late Doric. According to an ancient text, the Corinthian order was invented by a bronze-worker, Kallinikos. Nevertheless, its essential peculiarity, the bell-shaped transition between the short and the *abacus,* occurs in Egyptian work, and several variants appear in Greek work. The curling leafage and the volutes, which rise vertically as in older Egyptian, Eolic and Persian capitals, are so disposed as to soften and enrich the transition between the bell and the *abacus.* Otherwise, the order resembles the Ionic. It was rather too delicate for gen-

eral use as executed by the Greeks, and Greek examples of it are not numerous.

Decoration. As would be expected, the decoration in Greek architecture became progressively richer in design, materials and handling as the style progressed. In the Doric style it was in large measure painted until after the Great Period. Interesting frag-



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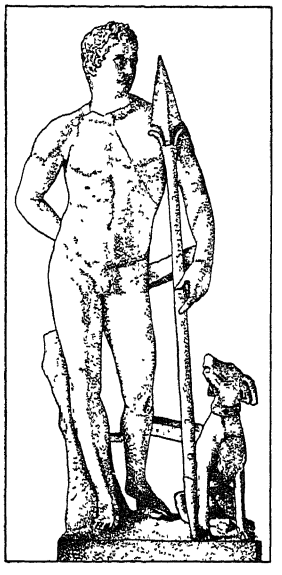
CAST OF A METOPE FROM THE PARTHENON, ATHENS

ments of painted terra cotta and marble elements survive. However, the use of carved figures on metopes and pediments began in the Archaic Period. These figures were themselves painted and did their part toward giving a lively effect to the building. It is fair to say, however, that the Greeks in painting their stonework did not destroy its glyptic and lithic quality, but merely enriched it. The Ionians were always more lavish with their decorative carvings than the Dorians, and this probably had something to do with the popularity of the Ionic in the florid taste of the later periods of Greek architecture; tours de force like the great Altar of Zeus at Pergamon, 2nd century B.C., were impossible in the Doric style. It is clear that the tradition of richly carved figure decoration and elaborate colored incrustations came to Roman architecture through the later Greeks, who were inspired to use it by Oriental influences. The Romans also took over the Greek tradition of wall paintings as interior decoration, and much of what we know about Greek work of this kind is inferred from Roman examples. K. C.

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GREEK ART. Next to literature, the Greeks expressed their national genius most eloquently in art. The technique which enabled them to translate their intellectual conception of grace into material form, which included sculpture and painting, began with certain of the buildings they erected in prehistoric Greece. (*See* ARCHAEOLOGY: Iron Age.) A middle period in the development of this art consciousness may be illustrated by the classic *structures,* some of them still to be seen in varying stages of preservation (*see* ARCHITECTURE, HISTORY OF). A third phase in the evolution of the art of the Greeks is represented by their relatively sophisticated minor arts, or their esthetic expression through the medium of POTTERY, COINS and GEM CARVING. The present article will deal briefly with the expression of Greek genius in sculpture and painting.

The archaeology of the 20th century has given to the prehistory of Greek art an increasing interest and importance, clearly indicating that its recorded development cannot be treated as a series of isolated events. This has led to the dividing of the history of primitive Greece into three periods: the Aegean, 3000-2000 B.C.; Minoan, 2000-1500 B.C.; and Mycenaean, 1500-1100 B.C. Between the last period and the rise of Hellas, or Greece, in the 6th century, lies an age of barbarism. Yet in this 1,000 years of gestation the dormant seeds of Oriental and Egyptian civilizations were quickening again into life, to bring to birth in this semibarbarous race of Aryan stock an art which reached its full maturity and perfection in the brief space of two and a half centuries. The gulf that separates the prehistoric background from the rapid rise, culmination and slow decline of Greek art, as reflected in the outlook and conditions in contemporary events in Greek history, may be spanned by first considering the influences and chief characteristics that gave Greek art its own character and genius.



MELEAGER THE ARGONAUT
In the Berlin Museum

Geographic position was a determining factor in the life and art of Greece. Greece is a mountainous country, so broken by gulfs and bays as to make it half land and half sea. Its soil was too poor to support the inhabitants, and thus they were forced to the sea to trade, and thus into close communication with the East and neighboring states. Ridges of mountains, rich in marble of peculiar fineness and hardness, divided the land into small districts, so that politically it was a collection of city states with an intense local pride and patriotism, fiercely jealous of each other, yet banding together for mutual defense against common enemies. From the hordes on the north they were protected by rugged hills easy of defense, and by the open sea on the south and the west.

In religion the conception of deities as patrons and guardians of the State, not to be feared but to be honored with festivals, strengthened the common consciousness of Hellenism. Thus based on the commercial principle and public ceremonial rites and penetrated by a common democratic ideal, these organized city states rapidly reached a Golden Age of art, of civic and religious origin. The temple, the shrine of the statue of the State's patron divinity, was

the center of public life. Besides the statue of the shrine, usually of gigantic proportions, there were detached statues, singly and in groups, of dedicated or commemorative portraits of rulers and distinguished athletes. Sculpture became the essence of Hellenism as the artist strove to make his figures fit for the indwelling presence of the gods. The gods of the Greeks were made in the image of their worshippers, but possessed all human attributes raised to the highest power of idealized perfection. With passionate devotion to perfection of "form" in art, in literature, athletics and every phase of public life, the line between the anthropomorphic gods and Greek heroes became narrower as the human perfection of the athlete served as a model for both. But "form" meant not merely a correct and vivid fidelity to nature in the representation of the structure of the human body, but the restraint of law and tradition. The Greek artist reduced the salient features of organic forms to artistic conventions, giving to the greatest monumental plastic effects, though they were stamped with his own personal genius, the distinguishing quality of abstraction.

Unlike the gigantic monuments built by the Orientals and Egyptians to the glory of their gods, the striking characteristic of the Greek temple was its simplicity and the perfect proportion between the various parts. Flat surfaces were enriched by sculptural decoration usually in carved relief depicting sacred legends, centering around the god whose cult statue stood within. The surfaces commonly decorated were the pediment or gable; the metope, a square space in the outer wall originally used for windows; and the frieze, the broad border immediately beneath the cornice, representing the cross beams. Decorative sculpture was under the supervision of the sculptor of the shrine statue but generally was executed by his pupils from his designs. The scantness of vegetation in Greece led to a paucity of floral designs, and these together with the animal forms bear a marked Assyrian impress. Traces of paint on the stone indicate that all parts of the temple were painted in brilliant colors to enhance the decorative effect. The great sculptors were great painters and their statues were radiant with color. Polychromy, especially in the earlier periods, was conventional rather than realistic. The use of blue for hair and beards, and red for bodies was common.

The history of Greek art is roughly divided into four periods: the archaic, 1100-480 B.C., from prehistoric times to the Persian Wars; the Transitional Period, from 480 to 450 B.C.; the Great Age, from 450 to 323 B.C.; and the years 323-30 B.C., the Hellenistic period from the death of Alexander to the Roman conquest.

Archaic Period, 1100-480 B.C. From the dark age that followed the Dorian invasion in 1100 B.C. which had swept away the high civilization of the Mycenaeans, there gradually emerged a modest development in handicrafts, particularly in pottery, which is known as the Geometric age from the type of geometric pattern evolved, a heritage from the Dorians. The ornamentation was simple, consisting chiefly of the meander, triangle, lozenge, zigzag, swastika, cross, star and circle, woven into a design. The human figure was reduced to a geometric formula. The torso was in inverted triangle, the head and limbs in profile, indicated by straight lines. Hybrid animal forms such as the sphinx, griffin and heraldic lion were used. There was no attempt to follow nature; the design was the end sought. Corinth, the commercial center closest to the East, is credited with the earliest Greek painting. Its patterns derived from the East, especially from Assyria. The fine black glaze handed down from the Cretans was used for the silhouette of the incised figures on a red or creamish ground. As figure painting developed, the sexes were distinguished by coloring the flesh of the women white and that of the men reddish brown. Red figure vase-painting did not become common until the 5th century. Vast quantities of these vases were distributed in the East and West throughout the reign of Greek art.

The earliest existing prehistoric sculpture in stone is the famous Lion Gate of Mycenae of c. 1100 B.C. Primitive religious images of wood were called *xoana,* to scrape wood. The most ancient Greek marble statues, an Artemis of c. 620 B.C. and a Hera of c. 580 B.C., were found at Delos. These illustrate well the characteristics of archaic Greek art; the bulging eyes, the awkward modeling of hair, the formalized decorative detail. The feet are planted firmly on the ground and the principle of frontality obtains. The Dorians, in the latter part of this period, were the first to break the convention of frontality in their "athletic art," and to pose their standing subjects in the "firm leg and free leg" position. In the Ionic School toward the end of this period much interest was concentrated on details of coiffure, drapery and ornamentation.

At Delos also was discovered the earliest example of a flying victory, or Nike, which has survived to modern times. Its face wears the "archaic smile," probably an attempt on the part of the sculptor to make the features expressive. It may be dated at approximately 550 B.C.

Under the government of Peisistratus, ATHENS was given her great start toward supremacy. Foreign artists were welcomed and those from Greece worked in the Assyrian and Persian courts. There was interplay and assimilation of foreign technique and influence. The Greek artist was gaining control of his tools and material. Rude chiseling and monstrous forms became more finished and naturalistic. The garish three primary colorings were softened. Sculptural decoration took on greater importance.

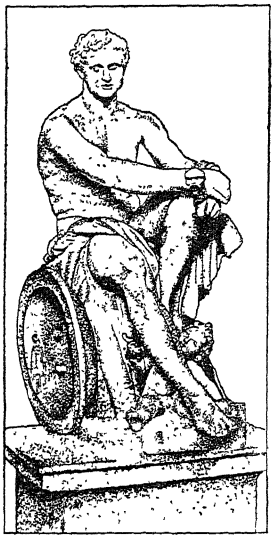
The Transitional Period, 480-450 B.C. This period, following the defeat of the Persians, was one of splendid development in art and literature. In art it marked the change from archaic formalism to complete freedom. Sculptors made greater efforts to render forms true to nature and to give expression to their subjects. The rigid archaic poses yielded to a

striving after animation. Archaic influences still remained, however, in the modeling of heads, with eyes too prominent, ears badly placed, and formal treatment of hair and beards. Among the great works of this period are the sculptures from the temple of Zeus at Olympia, the bronze charioteer of Delphi and the *Discobolus,* a superb example of arrested action and equilibrium, by the great master of the transitional period, the Attic Myron.



THE WOUNDED AMAZON
Statue by Cresilas, sculptor of Crete (5th century B.C.), in the Capitoline Museum, Rome

The Great Age, 450-323 B.C. Within this period falls the great age of PERICLES, when most of the East had been subdued by Greece. Pericles brought the treasury of the Delian League to Attica and expended its "dues" on the beautifying of Athens, which became the center of culture and art of the Hellenic world. Greek art reached its apogee about 430 B.C. The great war monuments were being erected and the temples ruined by the Persians, restored. The limited local outlook gave way to one more universal and consistent with the broadened horizon attained. The rapid progress made in painting and sculpture during the 5th century is without precedent in the history of art. The great artists were PHIDIAS of the Attic School and POLYCLITUS of the Dorian. Painting technique usually precedes that of sculpture, but means of judging Greek painting is slight. Reliance must be placed upon the careful detailed writings of Pausanius and other early Greeks, and through the copies of major painting reproduced on Greek vases and Roman mosaics. The great painters of the time were Polygnotus, Nicon and Panaenus. The Parthenon on the ACROPOLIS, finished about 438 B.C., and sacred to Athene, was the great architectural triumph. Phidias, the characteristics of whose work were idealism and nobility, was director of works. The gold and ivory statue of Minerva, within the shrine, was his masterpiece. His colossal bronze image of her towered above the temple without. The glint from the goddess's spear as the sun struck upon it was seen by the mariners 50 miles out at sea. The sculptural decoration of the pediment and frieze are also thought to reflect Phidias's style, though this is contested by some critics. These sculptures portray the legend of the birth of Athene from the brain of Jupiter. Fragments of these decorations are now in the BRITISH MUSEUM. The figures of the pediment, which are carved in the round, are known as the Elgin Marbles. The frieze bordered the outer wall under the cornice of the portico, and depicted the Panathenaic procession which every four years celebrated the gift of a new robe for the ancient wooden statue of Minerva of the Erechtheium, nearby on the Acropolis. Polygnotus painted the wind-blown draperies on the sculptures of the Parthenon. In the words of PLINY he was the "first to paint women with transparent garments and to give them headdresses of various colors." His most celebrated paintings were the *Taking of Troy* and the *Visit to Hades* at Delphi. Polyclitus, head of the school of sculpture at Argos and Sicyon, was renowned for his exceptional knowledge of anatomy and his proficiency in casting bronze. He was greatly interested in the ideal proportions of the human body and is said to have written a treatise expressing his ideas on this subject, called "The Rule." His best known work, the *Doryphorus* or spear-thrower, is perhaps the very statue he modeled to illustrate the points of his thesis. He also executed an image of Hera, the national goddess of Argos, and the sculptural decoration for the temple.



ARES
Statue in the Ludovisi Villa, Rome, a copy of the original of the 4th century B.C., sometimes attributed to Scopas

The Peloponnesian Wars which filled the early part of the 4th century transferred the hegemony in Greece from Athens to Sparta. The quality of Athenian art underwent a change. There was greater mastery of technique and a wider range of subject matter, but with loss of religious belief and political power the lofty ethical idealism and impersonal grandeur of the 5th century gave place to preoccupation with the gracious charm and delicacy of the human form rather than its vigor and action; there was less service for the gods and more for wealthy private patrons. Art became less ethical and universal and more emotional and sentimental. The new school of sculpture under PRAXITELES marked the transition and was active until 336, the time of ALEXANDER. His *Hermes carrying the child Dionysos,* found in 1877 in the temple of Hera at Olympia, is one of the few authentic, original Greek masterpieces, and shows a further humanizing of deity with languid ease and charm, as do also his statues of *Eros* and *Apollo.* Lysippus, head of the school of Argos and Sicyon, was the favorite sculptor of Alexander. He changed the canon of Polyclitus in the proportions of the body and emphasis of muscles and articulations, as may be observed in his *Borghese Wrestler.* Many archaeologists attribute to him or his school the Venus de Milo and Apollo Belvedere. The 4th century was one of the most brilliant in painting,

with Apelles as its greatest master. His equestrian portrait of Alexander won great renown because it was said to be so realistic that horses neighed at it.

Fourth Period, 323-30 B.C. In the strictest sense creative art in Greece ceased when the independence of its city states was subjugated by Alexander. Though there was great activity and expansion in architecture and its embellishment there was no freshness or invention. With the division of Alexander's empire into four monarchies at his death 13 years later, the artistic centers were divided between Alexandria, Rhodes, Tralles and preeminently at Pergamon. Sculpture lost its architectural significance and was concentrated, for the most part, on commemorative single statues, with an increasing tendency to depart from grandeur and serenity to a violent style of realism, expressing physical agony in contortions of the body, as exemplified by the *Laoçoön* of the Rhodian school and the *Farnese Bull* of Tralles. They show great technical and anatomical perfection and are the extreme of the pathetic tendency, verging on the histrionic. Members of the dynasty of Attalus of Pergammon were allies of Rome and patrons of art, drawing the great artists of the day into their pay. Attalus III in his will bequeathed his kingdom to the Romans. With the defeat of the Achean League and the sack of Corinth, when shiploads of art treasures were sent to Rome, Greek art entered into the servitude of the Romans, and its mastery of technique was exploited for the Roman love of splendor and pomp. One of the ships from Corinth was sunk off the rugged coast of Cythera, and has recently been recovered, bringing to light authentic 4th century bronze and marble statues. The 4th century painting by Philoxenos of the battle between Darius and Alexander at Issos has been in some sort preserved in the famous mosaic found at Pompeii, for which it was the model.



THE BORGHESE HERA

A Roman copy of a Greek statue of the end of the 5th century B.C., *now in the Glyptothek Ny Carlsberg (museum), Copenhagen*

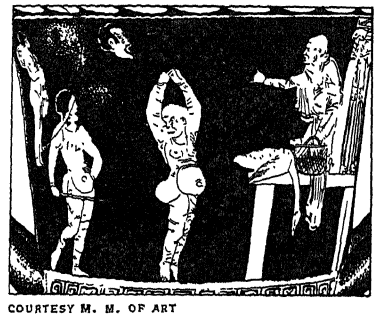
While the spirit of Greek art at its greatest was of a lofty idealism and universality dedicated to the service of the gods and the state, there should be some recognition of the intimate and personal aspect of Greek art, especially in its decadence in the Hellenic period when superstition and frivolity succeeded loss of faith and a sober devotion to the state. The exquisite figurines discovered in 1870 in large numbers about Tanagra, from which they take their name, are of the genre type. Daintily molded of terra cotta, and painted, they represent every phase of every day life. The workers in gold, silver and bronze brought the handicraft of vessels and jewelry to the high level of the major arts. Superstition which always follows loss of faith found expression in the carving of gems as talismans and charms. These with Grecian coins have a well-developed history of their own.

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GREEK CHURCH. *See* EASTERN ORTHODOX CHURCH.

GREEK DRAMA. Greek drama developed from the dithyramb, a combination of dance and song performed by a chorus in the worship of Dionysus (Bacchus), god of fertility and of wine. The chorus, clad in goat-skins and disguised as satyrs, sang and danced, and their leader told of the sorrows or triumphs of the god.

"Tragedy" means "goat-song" and was so called because a goat (*tragos*) was offered as a prize or was sacrificed to the god or because the chorus wore



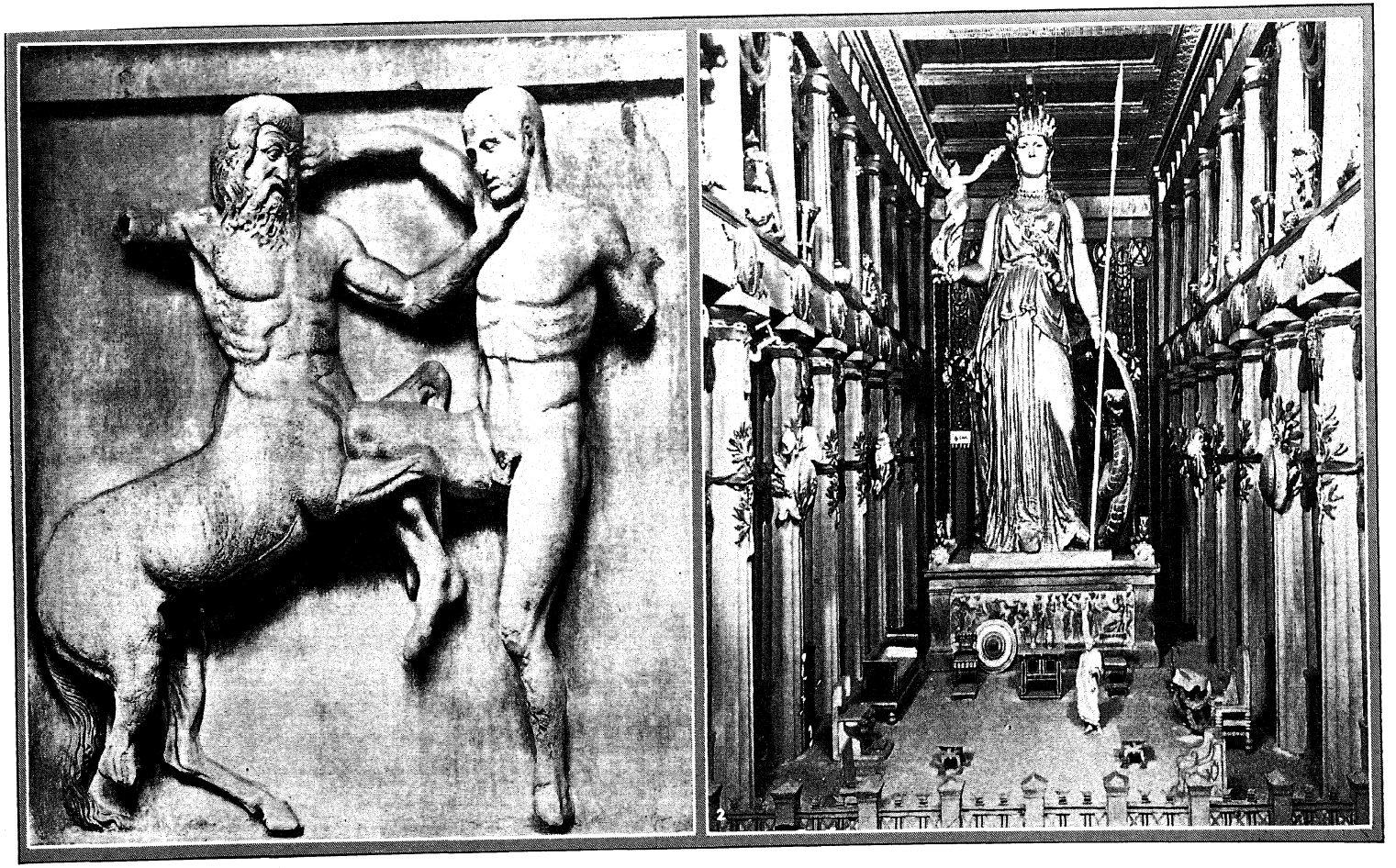
COURTESY M. M. OF ART

ACTORS PRESENTING A SCENE FROM A PARODY OF GREEK TRAGEDY

From a 4th century B.C. *south Italian bell krater, or vase*

goat-skins. Thespis, of Icaria, in Attica, is said to have invented tragedy, and in 534 B.C. it was introduced into the city festivals at Athens. At first there was only one actor besides the chorus; Æschylus introduced a second, and Sophocles a third. More than three actors were seldom, if ever, employed in Greek tragedies, and all parts were taken by men. If necessary one actor could take several parts. The chorus numbered 12 until Sophocles increased it to 15. There were often many supernumeraries.

Dramatic performances were given in Athens at two festivals of Dionysus: the Lenaean festival in January and the City, or Greater, Dionysia in March, both of which were under state control. In the 5th century B.C. poets and actors were paid by the state, but the chief expense was borne by the Choregi, wealthy men who made the performances as magnificent as possible. The poets competed for a prize, each



2. COURTESY METROPOLITAN MUSEUM OF ART

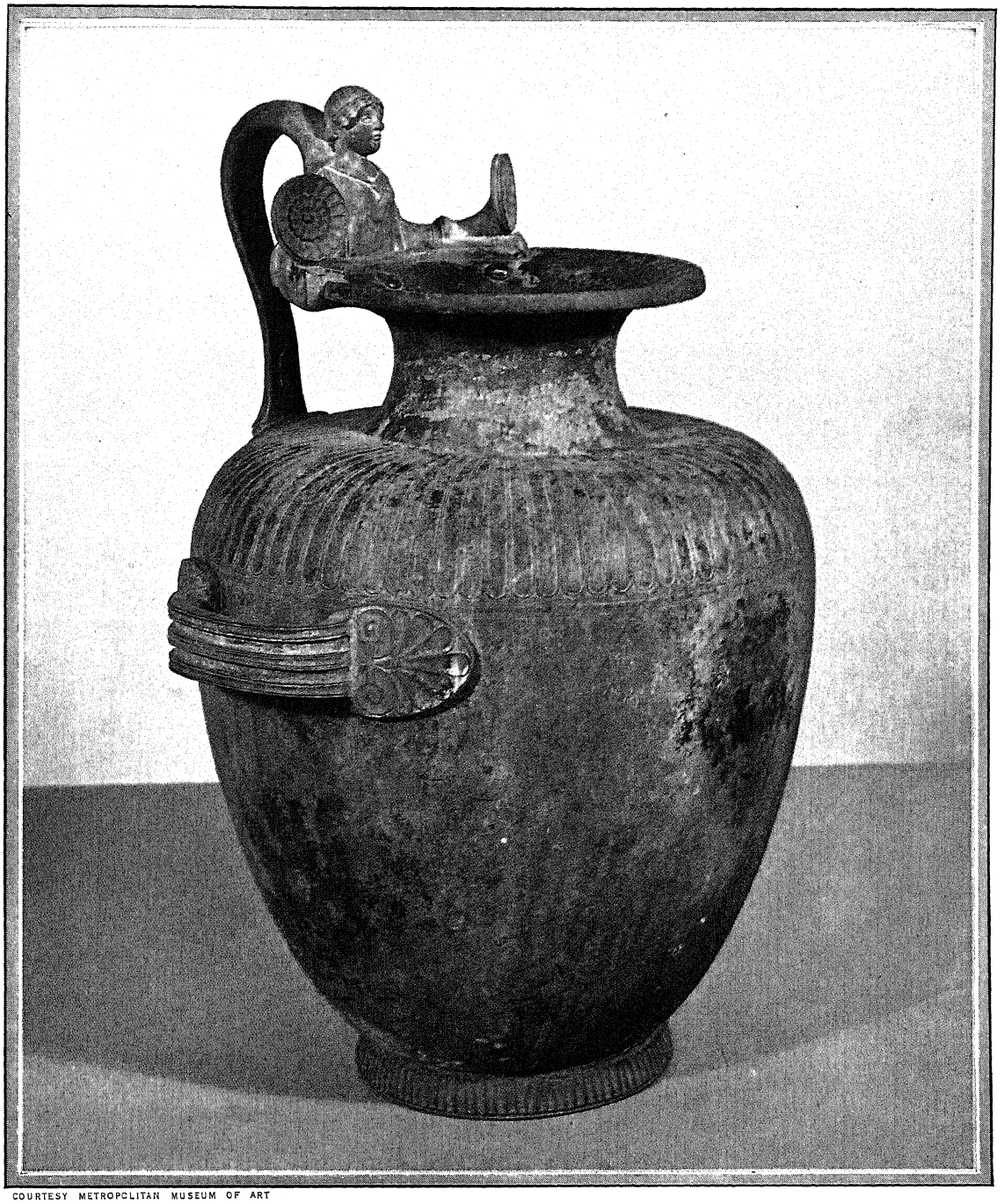
SCULPTURES OF THE PARTHENON

1. A metope relief taken from the Parthenon, depicting an incident in the historic struggle between the Lapithae and the centaurs.
2. Restoration of the Doric interior of the temple, showing the colossal statue of Athena which was carved in gold and ivory.



FAMOUS REPRESENTATIONS OF NIKÉ IN GREEK SCULPTURE

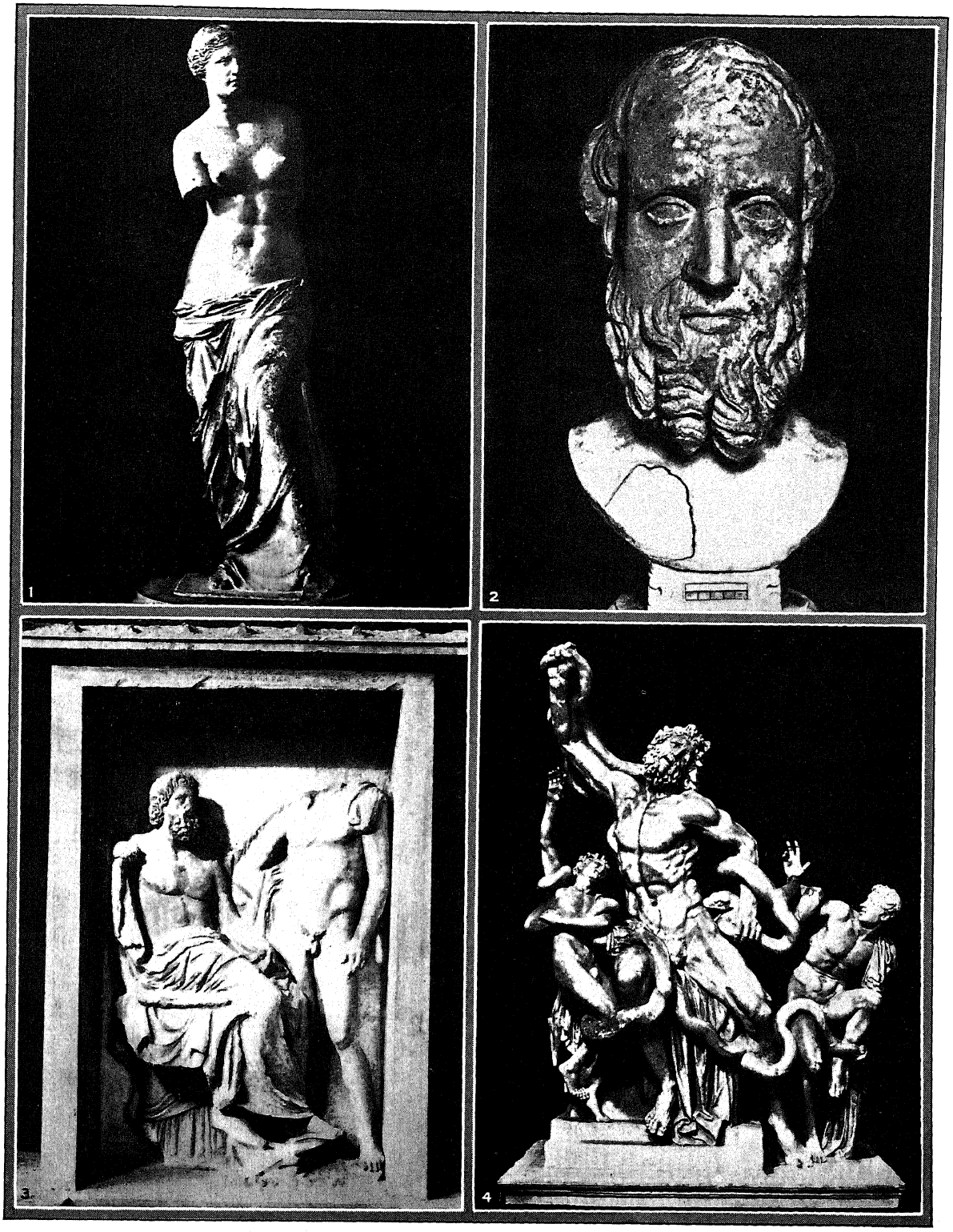
1. The Victory or Niké of Samothrace, 4th century B.C., found in 1863 on the island of Samothrace, now in the Louvre, Paris.
2. Niké fixing her sandal, 5th century B.C., a relief of the Temple of Athena Niké, Athens, now in the Acropolis Museum.



COURTESY METROPOLITAN MUSEUM OF ART

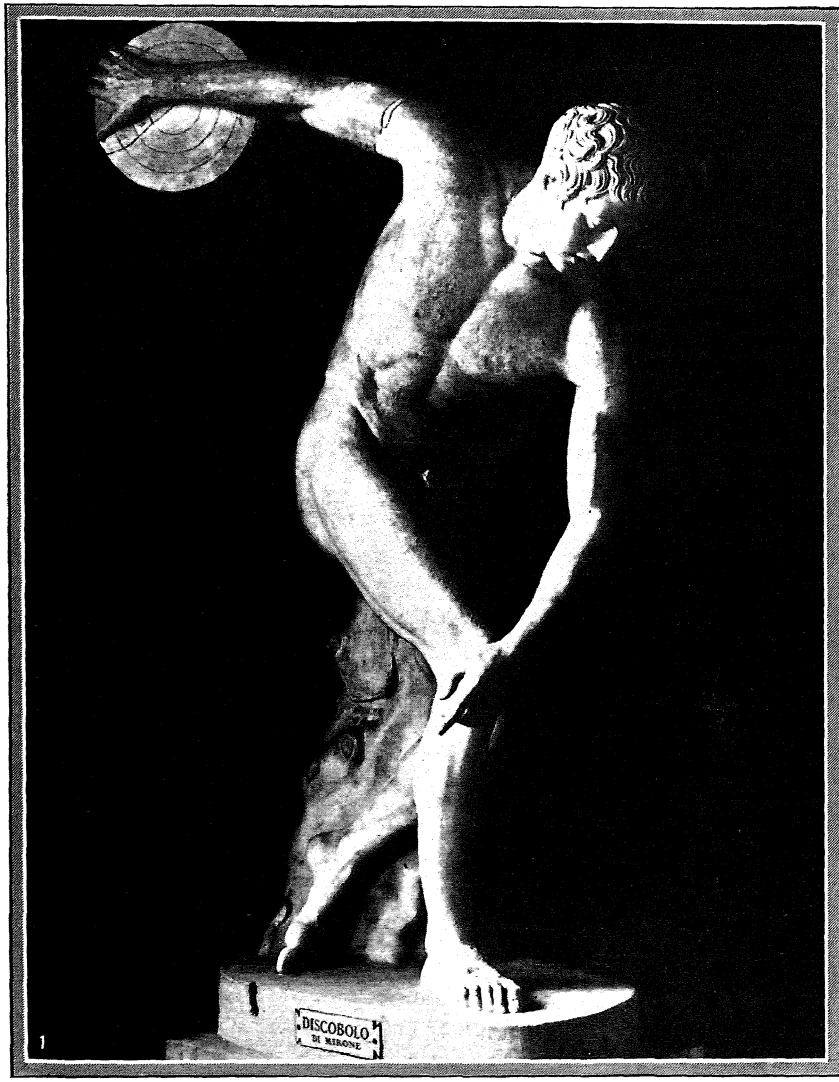
GREEK HYDRIA OR WATER JAR OF BRONZE

The jar, said to be from the Peloponnesus, dates from about 460-450 B.C.
It is inscribed, *"A prize from the games of the Argive Hera."*

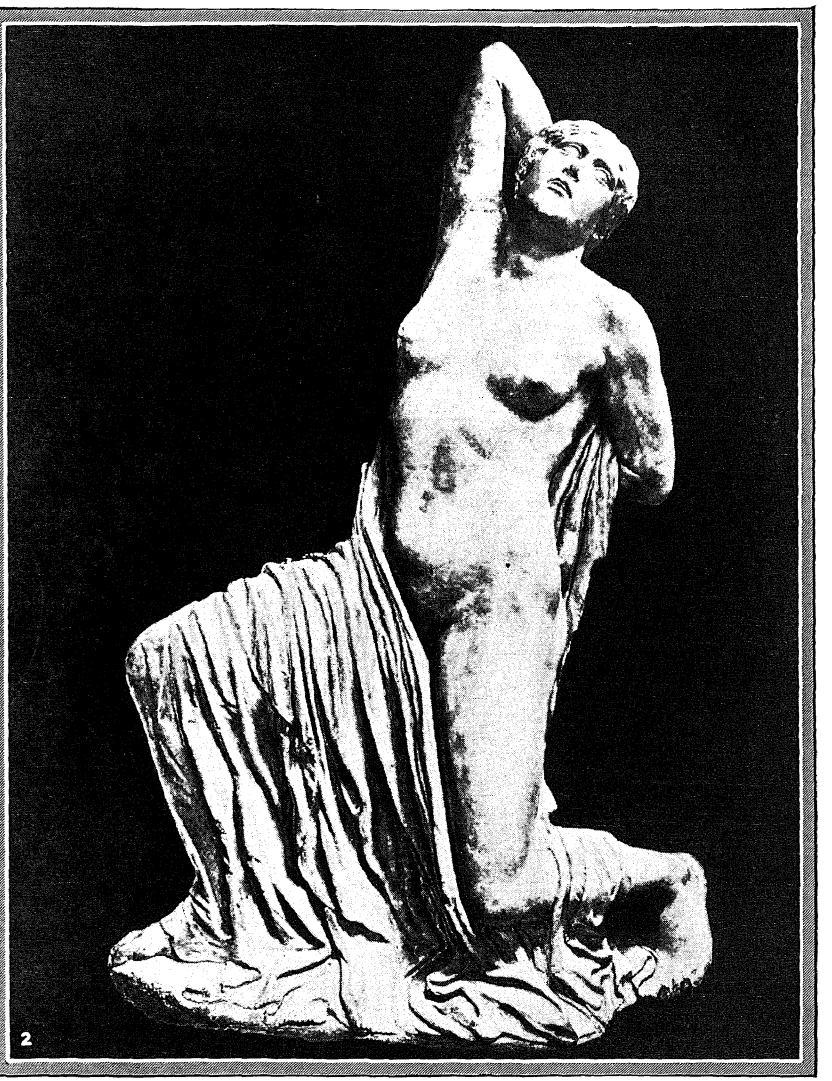


SCULPTURE OF THE ANCIENT GREEKS

1. The Venus de' Milo (about 400 B.C.), found in 1820 on the island of Melos. 2. Herodotus, in the Albertinum, Dresden. 3rd-1st centuries B.C. 3. Pentelic marble stele of Epichares (seated) and young man, Plato. 3rd-1st centuries B.C. 4. Laocoon and his sons with the serpents (1st century B.C.), in the Vatican, Rome.



1



2

GREEK SCULPTURE OF THE FIFTH CENTURY B.C.

1. The Discobulus, or Discus-thrower, by Myron. This statue, a copy, is in the Vatican Gallery, Rome; the original figure was of bronze.
2. Niobe, by an unknown Greek sculptor, regarded as one of the finest examples of antique sculpture. In the Terme Museum, Rome.

presenting three tragedies (a trilogy) and a satyr drama (making a tetralogy). The satyr drama was a kind of mythical burlesque in which the chorus consisted of satyrs with their father, Silenus, as leader, and the other characters were gods or heroes. Originally the poet trained the chorus and took the actor's part himself; but after the second and third actors were introduced acting became a profession. The earliest tragic performances were given in a circular dancing place or *orchestra* about which the spectators were grouped on a natural slope and wooden seats. Then a wooden scene-building, which served as a dressing room and also as a background, was built. The projecting wings of this were the *parascenia.* Chorus and actors entered the orchestra through the *parodoi,* open passages at the ends of the scene-building. The earliest stone theater, the Dionysiac theater at Athens, dates from the 4th century B.C. The scene-building was at least two stories high, and in front of it was the *proscenium,* with three doors and with marble columns like those of the *parascenia.* Chorus and actors performed in the orchestra, and usually the chorus, after once entering remained until the end. There was no real division into acts, no curtain and apparently no stage. The performers wore masks and costumes appropriate for the characters they represented, and apparently the actors wore thick-soled buskins to make them taller than the chorus.



GREEK TRAGIC ACTOR
From the 5th century B.C. Andromeda-Krater found at Capua

The greatest tragic poets were ÆSCHYLUS (525-456 B.C.), SOPHOCLES (497-405 B.C.), and EURIPIDES (485/480-405 B.C.). There were many others, but their works are lost. There are at present seven dramas by Æschylus, seven by Sophocles, and 19 by Euripides, including the *Rhesus,* which may not be by him, and the satyr drama, *Cyclops.* In the *Suppliants,* the earliest extant drama of Æschylus, more than half the play is choral, there are only two actors, and the second actor appears only twice. The only extant trilogy is the *Oresteia* (*Agamemnon, Choephori* and *Eumenides*) by Æschylus, produced in 458 B.C. In this the actors are three, they are much more important than in the *Suppliants,* and the chorus is less important. Æschylus brought the drama to maturity. His plots are simple, his thoughts grand and noble, his language sometimes obscure but always impressive, and his dramas are full of religious feeling. Sophocles, generally considered the greatest of the three great tragic poets, is equally religious. His plots are more complicated and his language is less magniloquent. The choral portions are as a rule shorter in his plays than in those of Æschylus, and the dialogue is more important. Euripides, who seems less religious than Æschylus and Sophocles, represents his gods and heroes feeling and acting like ordinary mortals, loving, hating, quarreling and arguing. He is the first to make love a chief element in the drama. His language is almost that of daily life, and his choral songs are often very beautiful.

Comedy, like tragedy, developed in the worship of Dionysus at Athens, though rude impromptu farces (mimes) and even some primitive written comedies existed elsewhere. "Comedy" means "comus-song," the comus being a procession of revelers who dressed in absurd costumes and sang ribald and often obscene songs. About 470 B.C. comedy became a recognized part of the Dionysiac festivals at Athens. Greek comedy has three divisions: Old Comedy, from the beginning to about 400 B.C., Middle Comedy, about 400-336 B.C., and New Comedy, about 336-250 B.C. Old Comedy imitated tragedy in form, with many variations. The chorus numbered 24, and at least once in almost every play came forward and addressed the audience directly on political and personal subjects. This was called the *parabasis.* The plot regularly involved a contest between two parties. One defeats the other, and ridiculous scenes result from the victory. Often the play ends with a marriage, for Dionysus was a god of fertility. Ten plays of the Old Comedy exist, all by ARISTOPHANES (b. about 450, d. after 388 B.C.). They are absurdly fantastic, full of sparkling wit, and contain some beautiful poetry, but are often coarse, indecent and obscene. The politics and persons of the day are openly ridiculed. In Middle Comedy personal abuse was absent, the subjects were mythological or were drawn from daily life, and the chorus was of little importance. The *Plutus* of Aristophanes belongs to Middle Comedy. New Comedy draws its plots from ordinary life, and the subject is usually love between a young man and a girl supposed to be a slave. Other characters are the youth's father, the girl's mistress, servants, a parasite, etc. In the end the girl proves to be of good family, and the young couple are married. There are many variations of this plot. The chorus merely supplies musical interludes between acts. MENANDER (343-292 B.C.) was the greatest writer of New Comedy. No entire play of his is extant, but several are partly preserved, and there are many fragments of others. His characters are admirably drawn, there are many amusing situations, the dialogue is witty and charming. Many other Greek dramatists are known by name, but only fragments of their works now exist. *See also* GREEK LITERATURE.

H. N. F.

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GREEK LANGUAGE, an important language forming a branch of the INDO-EUROPEAN linguistic family, the vehicle of incomparably the finest literature of the ancient world except the Bible, and pos-

sessed of an almost unbroken documentary record from the 9th century B.C. to the present day. Linguistically, its vocalism preserves pre-Indo-European conditions more faithfully than any other member of the family; it is remarkably conservative of primitive forms of inflection; and, generally speaking, it retains the pre-Indo-European system of ACCENT, so that, with SANSKRIT and LITHUANIAN, it is the chief source for any investigation of Indo-European comparative LINGUISTICS.

Popularly Greek denotes the language of texts written in the Attic dialect, together with literary documents in other dialects—epic, the language of the Homeric poems and their imitators; Ionic, especially HERODOTUS; Doric in the choruses of the dramas and the bucolic poets; Lesbian in the verses of SAPPHO, etc. The very numerous inscriptions, however, show a variety of dialects perhaps best grouped as Eastern and Western. To the former belong Attic-Ionic, Aeolic (Lesbian, Thessalian and Boeotian) and Arcado-Cyprian; to the latter, Northwestern (Phocian, Locrian, Elean, Aetolian, etc.) and Doric (Laconian, Cretan, etc.); mixed dialects are seen in epic (Aeolic and Ionic) and Pamphylian (Doric and Arcado-Cyprian).

When Athens rose to supremacy, her dialect progressively effaced all the rest and finally developed into a general literary language called Koinē, or "common," which flourished throughout the Hellenic world from about 300 B.C. to 600 A.D., not without new dialectal variations. The Koinē was followed by Byzantine Greek, and this by Modern Greek. The latter, which has undergone much modification in pronunciation, inflection and syntax, falls into two main divisions, puristic or literary and popular. The popular form, in its turn, is divided into a northern and a southern group, each with numerous dialects, all descended from the Koinē, not from the ancient dialects, with the exception of Zaconian, a survival of Doric, spoken in a small area on the western shore of the Gulf of Nauplia. L. H. G.

BIBLIOGRAPHY.—W. W. Goodwin, *Greek Grammar,* 1892; A. Thumb, *Handbook of the Modern Greek Vernacular,* 1912; K. Brugmann, *Griechische Grammatik,* 4th ed., 1913; S. B. Psaltes, *Grammatik der byzantinischen Chroniken,* 1913; E. Boisacq, *Dictionnaire étymologique de la langue grecque,* 1916; C. D. Buck, *Greek Dialects,* rev. ed., 1928; A. Meillet, *Aperçu d'une histoire de la langue grecque,* 3rd ed., 1930.

GREEK LAW. In a sense, the science of law began when Greek philosophers began to investigate the diversity of laws and customs as between different Greek communities, and between Greek and Barbarian, and to speculate upon the basis of legal and political application. But the Greeks did not develop professional lawyers in any other sense than professional writers of speeches for litigants. Hence the Greeks did not develop a system of law in the sense in which jurists use that term in the modern world. Greek writers include under the term which we translate law, ethical custom, religious rites, commercial custom, customs of arts or trades, and the codified law and enactments of a particular city-state. In other words, they thought of all social control rather than of that specialized type of social control through the force of politically organized society which we now call by the name of law. Nevertheless, Greek commercial institutions played a great part in the development of Roman law, and Roman jurists were profoundly affected by Greek philosophical thinking.

GREEK LITERATURE is remarkable for its originality and its vitality. Entirely without models the Greek genius created and perfected the main types of poetry, epic, lyric and drama, and the prose types of history, oratory and philosophy. Greek literature is the fountain-head of all western literature and its masterpieces have never ceased to command enthusiastic admiration. The Old Literature may be divided into Early, Attic and Hellenistic.

THE EARLY LITERATURE (c. 900-475 B.C.)

Epic Poetry. Greek literature begins with the Iliad and the Odyssey, attributed from the earliest times to HOMER, of whose life and personality nothing is known. The question as to the origin and composition of the Homeric poems has occupied the attention of scholars for more than a century, but the significant fact for the student of literature is the existence of the two great poems dating from a remote past, which were the source and inspiration of all later Greek literature and the model for a long line of imitators of many ages and nations.

The ILIAD and ODYSSEY were not the earliest literary creations of the Greeks, but the culmination of a long series of poetic compositions. One must assume an indefinite period of experimentation before there was developed the perfect instrument one finds in the dactylic hexameter of Homer. The earliest poetry was probably religious and connected with the personification of the forces of nature. There are traditions of early bards, such as Orpheus and Musaeus, of hymns to the gods, of marriage hymns and dirges; and the minstrel of the Odyssey, who celebrates the deeds of heroes, suggests the beginnings of epic poetry.

Beside the *Iliad* and *Odyssey* the ancients possessed a body of epic poetry which they attributed to Homer. Among the extant remains of this post-Homeric poetry is a parody on the Trojan War, the *Battle of the Frogs and Mice,* and a collection of pieces known as Homeric Hymns, used as preludes to epic recitation at festivals. The oldest and most beautiful of these is the *Hymn to the Delian Apollo,* relating the birth of the god and the founding of his worship.

HESIOD (c. 850-800 B.C.) carried on the epic tradition in the form of his verse, but produced works of a quite different character. The Homeric poet moves in the field of romance and ideal beauty; Hesiod moves among the stern realities of life. His chief work is the *Works and Days,* a kind of Farmers' Calendar. The *Theogony* attempts to explain the origin of the world and to bring into an orderly system the motley figures of Greek mythology. Hesiod originated didactic poetry.

Elegiac and Iambic Poetry. Between 700 and 500 B.C. a change came over the Greek world. Oligarchy, and in some places democracy, had displaced monarchy, class warred against class, injustice and aggression were the rule. Under these conditions there arose a new type of poetry which expressed the thoughts and feelings of the individual. Of this reflective poetry there were two forms, elegiac and iambic poetry.

Elegiac verse developed naturally from the verse of Homer. Its couplet form made it appropriate for brief and sententious utterance such as is found in maxims and inscriptions. It was employed for exhortations to war by CALLINUS and Tyrtaeus (early 7th century), for political manifestoes by SOLON (594 B.C.), for practical precepts by THEOGNIS (540 B.C.). In MIMNERMUS (620 B.C.) one finds a note of sentiment and melancholy that became characteristic of the Alexandrian and the Roman elegy. SIMONIDES OF CEOS (480 B.C.) in his inscriptions in honor of Greeks who fell in the Persian wars, brought the epigram to its perfection.

Iambic poetry was originated by ARCHILOCHUS (670 B.C.) who is said to have invented a large number of metrical forms. Its commonest variety was the iambic trimeter, a verse suited to the expression of vigorous and pointed thought. Archilochus was famous for fiery invective and his successors, Semonides of Amorgus and Hipponax, continued the satiric use of iambic verse. As an independent form, iambic poetry had a shorter history than elegiac, but its influence upon later literary forms was much greater. Iambic trimeter became the conventional verse for the dialogue of Greek tragedy.

Melic Poetry. Late in the 7th century one sees the beginnings of verse composed to be sung to a musical accompaniment, lyric or melic verse. Of this there are two main types, one designed for a single voice and expressing the emotions of the individual, the other designed for a chorus and voicing the sentiments of a community. The first is associated with the Aeolians, in particular with the island of Lesbos, and reflects the love of beauty and the intensity of feeling that characterized the Lesbians of that period. The second is Dorian in origin and bears the stamp of severity and symmetry characteristic of the Dorian temperament.

The great representatives of the Lesbian lyric are ALCAEUS, a robust singer with a wide range of song, and SAPPHO, the most famous love-poet of all time. The Ionian ANACREON is akin to the Lesbians in the form and subject of his lyrics, but lacks their depth and sincerity of passion.

Choral lyric had many forms, processionals, hymns to the gods, marriage hymns, dirges and panegyrics. Its traditional founder was ALCMAN (c. 650 B.C.). STESICHORUS (620 B.C.) composed choral pieces dealing with epic themes, which had a great influence upon tragedy. In the 5th century there were three great choral poets, Simonides, BACCHYLIDES and PINDAR. The odes of Pindar in honor of victors at the great games, are distinguished by splendor of imagination and richness of expression.

ATTIC LITERATURE (475-300 B.C.)

Tragedy. The culmination of Greek poetry is reached in tragedy, which arose and matured within the limits of a century. AESCHYLUS, the Father of Tragedy, was born in 525 B.C., EURIPIDES, who saw the beginnings of a decline, died in 406 B.C.

Greek tragedy grew out of the worship of Dionysus, the great nature-god, whose festivals were celebrated in connection with the cultivation of the vine. At first his worship consisted of a choral song relating some event in his life, but gradually, by steps imperfectly known, dialogue was added and the chorus became subordinate. Choral poetry through its entire history bore the marks of its Dorian origin and was composed in the Doric dialect, but the development of tragedy from it was the work of Athenian genius. A Greek tragedy consists normally of a prologue, a parodos, when the chorus enters the orchestra, three or more episodes or acts, each followed by a stasimon or choral song, and an exodos. The subjects of tragedy were regularly drawn from epic poetry.

The names are known of persons connected with the beginnings of tragedy and of others who succeeded the three great tragedians, who alone are represented by surviving works. Each of these contributed something to the technical development of tragedy and each had his own peculiar character. Aeschylus is distinguished by majesty and intense moral feeling; SOPHOCLES is preeminently the dramatist of human character; Euripides excels in pathos and romantic power.

Comedy. Greek comedy also sprung from the worship of Dionysus. The picturesque events in the life of the god and his connection with satyrs and other sylvan beings naturally gave occasion for jest and banter. The Dorians advanced a step toward comedy by the production of short farces, in which there was dialogue between actors and chorus. But artistic comedy originated about 470 B.C.

Old Comedy, known through ARISTOPHANES alone (427 B.C.), is a commentary on public life, political and social, moral and intellectual. Aristophanes was a great poet as well as a great satirist. Some of his lyrics can hardly be matched in literature. Of Middle Comedy there are no remains, but New Comedy is known through fragments of plays by Menander and translations or imitations by the Roman poets, Plautus and Terence. It resembles the comedy of manners.

Historical Prose. Greek prose was not used for literary purposes until after the three great types of poetry had been perfected. Literary prose began in Ionia, which had seen also the beginnings of artistic poetry, in the work of the so-called logographers, who compiled myths and genealogies or combined geography with description of foreign countries. The most famous logographers were Hecataeus and Hellanicus.

The first writer of artistic prose was HERODOTUS

(450 B.C.), who wrote an account of the Persian wars and the events leading to them. His work is a storehouse of information on customs and manners, and he has a gift for vivid narrative.

THUCYDIDES (424 B.C.), the historian of the Peloponnesian War, is the first philosophical writer of history and the first to use Attic prose. For vividness of delineation and sustained nobility of thought he has never been surpassed.

XENOPHON (394 B.C.) combined the life of a country gentleman with that of man of letters. His works include history, biography, the essay and historical romance.

Oratory. That oratory is a distinct branch of Greek literature is due to the peculiar conditions of life in the 5th century and later. Public speaking was indispensable for a citizen who had ambitions for leadership or who might have to defend himself before a law court. In response to the demand for skill in public speaking there arose a class of rhetoricians who taught and exemplified the principles of oratory, among whom GORGIAS, a Sicilian, influenced profoundly Athenian eloquence.

Ten Attic Orators are listed by Alexandrian critics: Antiphon, Andocides, LYSIAS, ISOCRATES, Isaeus, DEMOSTHENES, AESCHINES, LYCURGUS, Hyperides and Dinarchus. In their works one can trace the gradual development of a highly finished prose. Lysias was famed for the naturalness of his style, Isocrates for his flowing periods; Isaeus marked the transition from the "plain style" of Lysias to the technical perfection of Demosthenes, whose command of all the resources of literary art have caused him to be rated the greatest master of Greek prose style.

Philosophy, the third great type of prose, owes its admittance into the domain of literature to PLATO, who invented the dramatic dialogue as the vehicle of his philosophical theories. There are 25 or more dialogues of Plato, which are masterpieces of literary art. His style exhibits a perfect combination of poetry and prose.

ARISTOTLE, who took all knowledge for his province and by his writings enormously influenced modern thought, belongs rather to science than to literature. THEOPHRASTUS, his successor, contributed to literature lively sketches of human types entitled *Characters,* which became models for similar sketches in modern times.

HELLENISTIC LITERATURE

Alexandrian Period (300-146 B.C.). After the conquest of Greece by Macedonia Greek literature lost its spontaneous character. Works of erudition were produced in prose and poetry was learned and artificial. The romantic elegy was cultivated and the epigram was employed to express the whole range of human interest. Epic poetry was used for the display of learning and research. The most famous representatives of this learned poetry are CALLIMACHUS, who composed elegies, hymns, and epigrams, and Apollonius of Rhodes, author of the *Argonautica,* a work of considerable literary interest. In two forms of poetry alone are originality and true feeling, the pastoral and the farce or mime. THEOCRITUS, creator of the pastoral, is the only pastoral poet who shows a genuine love of nature. Among his "idyls" are mimes and short epic tales. BION and MOSCHUS wrote pastorals of charm and pathos and Herodas composed mimes of a vigorous and realistic character.

The Greco-Roman Period (146 B.C.-529 A.D.). The conquest of Greece by Rome caused the life of Hellenism to be absorbed into the universal system of Rome. Thereafter Rome furnished the impulse to literature, which had four great departments: history and biography, erudition, rhetoric and philosophy. The most famous writers are POLYBIUS, historian of the Roman conquest, PLUTARCH, who wrote *Parallel Lives* and ethical pieces called *Moralia,* and LUCIAN, who, in the best Attic Greek that had been written for 400 years, composed satiric and imaginative pieces that have greatly influenced modern literature. The Greek Romance originated in this period, there was a revival of the epic in the frigid works of Nonnus and Quintus Smyrnaeus, and collections of verse were produced, notably the *Greek Anthology,* consisting of epigrams ranging over a period of about a thousand years.

A. L. BA.

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GREEK ORTHODOX CHURCH. *See* EASTERN ORTHODOX CHURCH.

GREEK PHILOSOPHY. Greek genius, including philosophy, flowered rapidly. Yet it can hardly be said that Greek philosophy sprang, like Athena, full-armed from the head of Zeus. Tendencies derived from primitive sympathetic magic, early mythology, and cosmogony are clearly present in the first Greek philosophers, and reappear with added impetus after Aristotle. But the essential novelty in Greek philosophy was its attempt to explain the world, both physical and human, in an impartial or disinterested fashion. Its explanations sought primarily to satisfy the demands of a theoretically good explanation as such. As the Greeks saw it, such an explanation of the world must point out some principle which gives us insight into the unity of the world and at the same time is capable of accounting for the diversity and change discoverable therein.

Early Philosophers. The pre-Socratics (6th and 5th centuries B.C.) were primarily concerned with finding some concrete sort of thing which would satisfy this requirement, particularly for the physical world. The Milesian philosophers chose water (Thales), the boundless (Anaximander) and air (Anaximenes) as the sort of stuff giving a unified basis or nature to all things. And they accounted for differences and change by such alternating processes as the encroachment of the opposite tendencies of warm-dry and cold-moist (Anaximander) and the condensation and rare-

faction of the world stuff (Anaximenes). The Pythagoreans seem to have had a like principle of unity in their "Unlimited." For them, however, the fact of difference and relatedness was so significant as to call for a separate principle, "Limit." The union of these two could account for everything, since all things are related and relations are reducible to numerical form. Numbers are in fact nothing but the Unlimited limited in definite ways, that is, space shaped into geometrical figures. Thus numbers are triangular, square, etc. If the Pythagoreans stressed difference as expressed in spatial forms of relatedness, Heraclitus may be said to have stressed difference as expressed in change. As world stuff he accepted fire, perhaps because of its very impermanence, and identified it with a world reason whose very nature seems to reside in the orderliness of change. Everything constantly changes, but one can understand this change because it is not merely chaotic; it forms an Upward and a Downward Way, processes directed respectively towards the more vaporous and the more solid.

With the Eleatics, Xenophanes, Parmenides, Zeno and Melissus, we have almost attained a recognition of the nature and problem of explanation itself. They saw that to explain things meant to find their identity. But this, they thought, is precisely to deny the factor of non-identity. Hence if the world is really capable of explanation it must be simply one throughout; the diversity and change revealed by the senses must be unreal since unthinkable. This was driven home by Zeno's paradoxes which aimed to show that if you assume the reality of change and difference you get into absurd self-contradictions. For example, the moving arrow must at any moment be at rest; but no sum of resting arrows will give a moving one. Yet the Eleactics were still concerned with finding one sort of thing which would furnish a good explanation of the world. Their Being was filled space or continuous matter and was spherical in shape, though Melissus argued for its spatial infinity. The Pluralists would not allow the Eleatic denial of change and difference to go unchallenged. So they emphasized spatial separation and combination of different stuffs or particles as giving rise to the differences and changes observable. They still sought an identity by positing permanent real things: Empedocles, the four roots, earth water, air and fire; Anaxagoras, seeds, each of which has parts of everything in it; Leucippus and Democritus, atoms which are qualitatively the same, differing only in size, shape, position and arrangement. But they each developed also a principle of change in the form of a cause of spatial motions of these permanent elements: Empedocles, Love and Hate, which are integrative and disintegrative forces, respectively; Anaxagoras, a cosmic intellect which originally started the rotary motion developing a world out of primeval chaos; Leucippus and Democritus, an inherent motion in the atoms which is further complicated by impact and recoil.

Thus the pre-Socratics can be said to have been looking for concrete sorts of things which would satisfy the two-fold requirement of a good explanation of the world, primarily the physical world. With the Sophists, Socrates, Plato and Aristotle, however, we get an interest not only in explaining man as well as nature, but also in explanation itself. Is explanation possible, and what does it presuppose? The more speculative Sophists tended to deny its possibility. For example, Protagoras said that man is the measure of all things, that is, we must accept the change and particularity of each individual's direct experience as ultimate, and no further identity can be legitimately asserted. A like denial of explanation was later made by the Sceptics, who held that apart from direct appearances we can legitimately assert nothing. In answer, Socrates (469-399 B.C.) tried to show how explanation is possible. The unity or universality required is to be found in general concepts which are implicitly present in the thinking of all men, and are to be discovered by judicious questioning and criticism which seeks to avoid error by trying to discover negative instances of any elicited definition. Socrates himself apparently confined his interest in explanation to explanation in ethics, where his conclusion was that "know thyself" is the maxim. That is, the explanation of moral virtues is to be found precisely in that wherein they are identical, viz., they all exemplify knowledge of the good.

Plato. But in Socrates's pupil, Plato (427-347 B.C.), not only is general analysis of explanation and the attempt to exemplify it in ethical and social matters carried further, but the earlier attempt to apply it to the environing world as well is resumed. Explanation must always be an attempt to discover identical natures or standards implied in all specific cases of the sort of thing explained. These identical natures Plato called Forms or Ideas, and there are apparently as many of them as there are significant sorts of things to be explained. The obvious problem is that of the relation of these forms to the changing particulars which they serve to explain. To this problem Plato appears to give many answers, due perhaps to a development or to a fundamental indecision in his own thought. One answer is that these forms have no connection with the observable realm of changing particulars. The forms alone are real. All else is illusion, involves non-being. Another answer is that sense things approximate these forms to different degrees, the forms serving as standards of comparison and as ideal goals, glimpses of what our knowledge would be if it were perfected. Another answer is that these forms were models in God's mind when he created the world, but because he had to use a necessary, irrational matter to give them content, they were none of them perfectly embodied in this world. But is there any explanation of the world as a whole? That is, can we designate any one form or set of forms as presenting an identity underlying all fact? Though Plato in places seems to suggest that the forms are independent of one another, nevertheless his general position is that they constitute one system. Often he urges that this system has as its highest term and as

source of all others the Form of the Good. For example, goodness, along with the two other most important forms, truth and beauty, takes the place of earlier world stuffs in giving us an ultimate identity explanatory of the cosmos. In ethics and politics, Plato selects the form of justice, each element performing its own specific task for the good of the whole, as giving the basic unity required.

Aristotle. Though following Plato in the main ARISTOTLE (384-322 B.C.) did not think the latter had properly united explanatory concepts, or forms, with the world to be explained (changing sense phenomena). He therefore placed much more emphasis than did Plato upon a principle suggested by the latter, viz., matter. Matter differentiates; form is the aspect of sameness or universality. Change is a process whereby any specific matter gives up some forms and gains others. To know, to explain, is to discover a common form as embodied in different matter, to give the class definition for the cases considered. If you know what is true of the class, or form, and you know what members, or embodiments of the form, belong to the class, you can demonstrate or deduce what is true of any one or more members. Thus to explain is to classify. But you must start with things to be explained (individual things or substances) as real, as data, if your explanation is to have significance. Thus Aristotle is usually spoken of as an empiricist. He applied this type of explanation to practically all kinds of phenomena observed during his time. But for philosophy the major interest resides in his attempt to give a world-explanation. There are two chief suggestions here. One is that there is one highest form which can serve to explain all else because it alone is unembodied, free from all union with matter. This pure form is God. He is changeless, undifferentiated, a pure identity. But how can such a form serve to explain a changing world? Unmoved, he moves the universe, and though this causation appears at times to be mechanical, a rotation of the sphere of fixed stars, on the whole it appears to be simply the drawing-power of an ideal. This links up with the other suggestion of a world explanation, viz., that all the forms are related in one developmental system, for a given form is matter in relation to some higher form, just as a class can be a member of a larger class or a goal can be a means to a further goal. Thus the world would appear to form a single, classificatory, purposive system. In ethics, Aristotle's explanatory concept is happiness or the unimpeded functioning of an organism, which in man reaches its highest expression in the unimpeded exercise of thought.

Following Aristotle. After Aristotle, to the closing of Greek schools of philosophy by Justinian in 529, Greek philosophy lost its interest in the problem of explanation as such and in attempts to formulate a suitable world explanation. So far as it did deal with these problems it was largely eclectic; different schools tried to patch together consistent views out of materials furnished by previous philosophies. The main concern turned toward practical measures for gaining peace of mind in a distracted world and salvation for a life to come. The search for a moral unity in life to which one could cling was in its way, however, an attempt to find an explanation in the realm of practical issues. And in general the schools all agreed as to the ultimate identity underlying what is practically good; it is imperturbability, serenity. He who found this was a wise man. Epicurus found serenity by escaping all difficulties and hardships. The Stoics found it by meeting trials unflinchingly and judging them as not evil, but, in relation to the total scheme of things, as good. The Skeptics found serenity in suspension of judgment. Since we do not know what things are really good or bad, they held, there is no use getting excited over things which simply appear to be good or bad.

In Neo-Platonism and Neo-Pythagoreanism there was added to this practical interest a mystical and religious emphasis. But in one Neo-Platonist the truly theoretical interest seems to have been revived to quite an extent, viz., in PLOTINUS (204-269), a Greek who spent most of his life in Rome. He explained the world in terms of a simple, changeless One, on the one hand, and a process of emanation, or differentiation by overflow, from this One on the other. Plotinus clearly saw that this One, since itself exclusive of everything non-identical, is ineffable, for all our assertions about it differentiate it and relate it. Thus though it is the final seat of existence, we can just as truly say of it that it is nothing as that it exists; and though it is the source of all goodness, we can no more truly call it good than evil. For our intellect, by distinguishing, limits itself to the region of emanations, the highest of which constitute a system of Platonic forms, and only in mystic ecstasy can we gain insight into the simple identity of the One. St. Augustine, who may be taken as inaugurating medieval philosophy, united in his thought Plotinian neo-Platonism with Christianity, and so Greek philosophy was carried over into medieval thought. E. W. H.

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GREEK REVIVAL STYLE, in architecture and the decorative arts, a style resulting from the attempt to use Greek forms as the basis for a modern architecture. Winkleman's (1717-68) researches had begun to establish a basis for the differentiation of Roman and Greek antiquities, and the publication of Stuart and Revett's *Antiquities of Athens* (1762-1830), followed by the *Antiquities of Ionia* (1797-1815) with drawings at once accurate and beautiful, made familiarity with Greek architectural forms easy. Moreover, in the early 19th century the Greek struggle for independence was winning a deep sympathy in England and America, and served to focus popular attention upon everything Greek. And the purity and beauty

of the Greek forms shown in the published books could not but appeal to the artists and the critics. In architecture the Greek Revival appeared first in Germany, in the Brandenburger Thor in Berlin, by K. G. Langhans, with slightly modified Greek details, as early as 1788. And Greek details were used tentatively in much of B. H. Latrobe's early work on the United States Capitol a little later. The earliest use of the fine Greek Doric pedimented temple front, which later became common in England, Germany and America, was in the 2nd Bank of the United States, in Philadelphia, by Latrobe in 1819-24. The greatest popularity of the style, however, was in the period from 1820-40, when not only many large monumental buildings and even churches were built in the Greek style, but also, at least in the United States, many town and country houses as well. In these there were frequent charm and beauty because differences of program and of materials prevented any mere academic copying of detail, and creative adaptation took its place.

The Greek Revival was necessarily a short-lived and sterile style, for the Greek climate and ideas of life were too different from those of Germany, England and the eastern United States. Compromises were always necessary, and the trend of the times, which led to correctness of detail as the end of design, almost always made those compromises bad. The Greeks had no important windows; in modern buildings windows are a dominant consideration. The rich polychromy of the Greek detail was impossible to copy, and was perishable in frost and smoke. And most important of all, nowhere could architectural sculptors be found great enough to ornament the bare metopes, friezes and pediment gables of the Revival buildings. For bibliography *see* MODERN ARCHITECTURE.

GREEK WAR OF INDEPENDENCE, THE, refers to the rising of the Greeks against Turkish domination, beginning in 1821 and ending in 1833 with the establishment of their independence. The war falls naturally into three phases. During the first, from 1821-24, the Greeks waged a war against the Sultan's forces without foreign assistance. The ground for Greek independence had been prepared by the agitation of the Hetairia Philike (Association of Friends), a powerful secret organization. In 1821 the revolt was inaugurated by a futile uprising under the leadership of Prince Alexander Ypsilanti. This was followed by an insurrection in Morea, in southern Greece, the aim of which seemed to be the mutual extermination of Greeks and Turks. On Easter Sunday the venerable patriarch, Gregorios of the Greek Church, was hanged in full pontifical vestments. During the second phase of the war the Turkish Sultan, Mahud II, unable to overcome the insurgents, called upon his vassal, the pasha of Egypt for assistance. With the appearance of the efficient Egyptian forces, the tide turned against the Greeks. The third phase begins with the intervention of the European powers. In Apr., 1826, Russia and England arranged a protocol, providing for mediation on the basis of recognition by the Turkish government of Greece as a tributary dependency. On July 6, 1827, by the Treaty of London, England, France and Russia again offered mediation on the basis of the 1826 protocol and demanded that an armistice be declared. Upon the refusal of the Sultan, his naval forces were completely destroyed at Navarino in Oct. 1827. In Dec. 1828, the Allied Powers agreed to guarantee the independence of Greece. In the meantime the Russo-Turkish War broke out, necessitating the withdrawal of the Turkish forces from Greece, and terminating with the Treaty of Adrianople in Sept. 1829, in which the Sultan recognized Greece as an independent kingdom under the guarantee of England, France and Russia. In 1833, Greece was organized as a kingdom, with the Bavarian prince Otto becoming "King of the Hellenes."

GREELEY, HORACE (1811-72), American journalist and political leader, was born at Amherst, N.H., Feb. 3, 1811. His name heads the roll of American newspaper-men of several decades ago who made so-called "personal journalism" an effective political and social weapon. Greeley began his career as a journeyman printer and landed in New York in 1831. There he opened a printing-office and began the publication of the *New Yorker,* a literary weekly that slowly won an audience. His Whig sympathies led him, in 1838, to the editorship of the *Jeffersonian,* and in 1840 he began publication of the *Log-Cabin,* in which weekly he gained a national reputation as a trenchant commentator on politics of the day. The following year he established the New York *Tribune,* which he continued to edit for 30 years, and which was valued, upon his death, at more than $1,000,000. Greeley's journal discussed all the leading issues of the day, and fiercely opposed slavery. After the Civil War, he took issue with Republican policies of Reconstruction, and in 1872 he was nominated for the Presidency by the Democrats and the Liberal Republicans. He was badly defeated. The blow to his pride, combined with the shock of his wife's death a week before the election, provoked inflammation of the brain, and he died Nov. 29, 1872, at Pleasantville, N.Y. *See also* NEWSPAPER.

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GREELEY, a city in northeastern Colorado, the county seat of Weld Co., situated 54 mi. northeast of Denver. It is served by three railroads. The principal local manufactures are beet-sugar, flour and canned vegetables. The total of manufactures, 1929, amounted to $1,935,244. In 1929 the retail business reached a total of $11,767,142. The city is also an important shipping center for live stock, potatoes, onions, cabbages, beans, fruit and grain. The State Teachers College is located here. Greeley Colony, named for Horace Greeley, was settled in 1870 by New Englanders. The first attempt in Colorado to practice agriculture with the aid of irrigation was

made here and met with remarkable success. Greeley became a city in 1886. Pop. 1920, 10,958; 1930, 12,203.

GREELY, ADOLPHUS WASHINGTON (1844-), American explorer, was born in Newburyport, Mass., Mar. 27, 1844. He served during the Civil War, afterward becoming a brigadier general. He was later appointed chief of the United States signal service, and from 1887-1904 supervised the erection of thousands of miles of telegraph lines in United States and its possessions. He had charge of relief work at San Francisco, following the earthquake in 1906, and was the representative of the United States at the coronation of King George in 1911. Greely is the author of *Three Years of Arctic Service, Handbook of Alaska, Polar Regions of the 20th Century* and other works.

GREEN, HETTY HOWLAND ROBINSON (1835-1916), American financier, was born at New Bedford, Mass., Nov. 21, 1835. The moderate fortune left her by her father she invested shrewdly, and became known as the wealthiest woman in the United States. In 1867 she married Edward H. Green, who died in 1902. During her lifetime there was scarcely a large-scale industrial enterprise in which she was not represented, and she held valuable real estate properties in Chicago and New York. Her enormous riches, which were left to her son, were in sharp contrast to her simple mode of living. Mrs. Green died at New York, July 3, 1916.

GREEN, JOHN RICHARD (1837-83), English historian, was born at Oxford, Dec. 12, 1837. Educated in his native place, he took orders and accepted the living of St. Philip's, Stepney. His health failing, he was made librarian at Lambeth in 1868. In 1874 he published his *Short History of the English People,* a work in four volumes. Owing, perhaps, to its vivid, picturesque style, it became popular almost immediately and remains to-day one of the most widely-read of English histories. In 1877-80 he expanded it to four volumes. His later works, *The Making of England,* 1882, and *The Conquest of England,* 1883, are done in a more objective vein. He died of consumption, at Mentone, France, Mar. 7, 1883.

GREEN, JULIAN (1900-), American novelist, was born in 1900 in Paris, of American parents. After attending French schools and serving in the latter part of the World War, he went for 2 years to the University of Virginia, then returned to Paris and devoted himself to writing, in French. His first novel, *Mont Cinere,* was translated in 1927 as *Avarice House.* In 1926 his second novel, *Adrienne Muserat,* won the Femina-Bookman Prize; it appeared in English as *The Closed Garden.* Among Green's other works, noted for their powerful subjective analysis, are *The Dark Journey,* winner of the Harper Prize in 1929, and *Christine,* a book of short stories, 1930.

GREEN, PAUL ELIOT (1894-), American dramatist and educator, was born in Lillington, N.C., Mar. 7, 1894. He was educated at Buies Creek Academy, the University of North Carolina and at Cornell, and in 1923 became assistant professor of philosophy at the University of North Carolina. He wrote *The No 'Count Boy,* 1924; *Fixin's,* with Erma Green, 1924; *The Lord's Will,* five plays for the Negro theater, 1925; *In Abraham's Bosom,* 1926, Pulitzer Prize Play, 1927; *In the Valley,* 1928; *Wide Fields,* short stories, 1928; *Tread the Green Grass,* 1929, and *The House of Connelly,* 1931.

GREEN, THOMAS HILL (1836-82), English philosopher and historian, was born in the rectory at Birken, Yorkshire, Apr. 7, 1836. He was educated at Balliol College, Oxford, where he became a fellow in 1860. In 1878 he was appointed Whyte Professor of Moral Philosophy at Oxford University, which position he held until 1882. Green was recognized as the leader of English idealism. Influenced by Kantianism, he was opposed to the naturalism of Darwin and Spencer and the utilitarianism of Bentham. In order to account for experience he introduced a trans-empirical principle in the form of a relating self. In ethics this gives rise to self-realization as the goal of moral endeavor. His main philosophical works, *Prolegomena to Ethics,* 1883, and *Principles of Political Obligation,* 1901, were published posthumously. For his work as a historian he is known for *A Short History of the English People.* He died at Oxford, Mar. 26, 1882.

GREENAWAY, KATE (1846-1901), English illustrator and juvenile writer, was born in London, Mar. 17, 1846. She began to exhibit water-color drawings at the age of 22. Her illustrations for children's books are among the most notable of their kind. Her best known productions include *Under the Window,* 1879, the *Birthday Book, Mother Goose* and *Little Ann.* Highly praised by contemporary critics for her illustrations and water-color drawings, she also wrote distinguished children's verse. Kate Greenaway died at Hampstead, London, Nov. 6, 1901.

GREENBACK PARTY, a minor political party in the United States which presented a presidential ticket in 1876 and, under the name Greenback Labor party, in 1880 and 1884. Its fundamental principle was the theory of fiat money (i.e., that governments declare by fiat what shall be legitimate currency for their peoples), issued and controlled by the Government, not by banking corporations. After the Civil War agitation over the retirement of greenback notes issued during the war and the resumption of specie payments promoted defections of paper-money advocates from the major parties. On Nov. 24, 1874, the first national convention of such advocates, meeting at Indianapolis, resolved that the circulation of notes issued by state and local banks should be prohibited; that the only paper currency should be greenbacks issued by the National Government, exchangeable on demand for bonds bearing interest at 3.63 per cent; that specie should be used only to pay interest on the national debt, greenbacks being made legitimate payment of debts and taxes.

The failure of the Democratic national convention of 1876 to nominate a presidential candidate sharing their views prompted the greenback advocates to form an independent party. PETER COOPER, its nominee, received 81,737 votes. Assimilating numerous local parties of dissatisfied workingmen, in 1880 the party modified its name, added to its platform planks upon the rights of labor, and nominated James B. Weaver, of Iowa, for president. Weaver received a popular vote of 300,867; but the party's strength in the House of Representatives, 14 in 1878, fell to eight. Beginning in 1884 the Democratic party in several middle western states effected fusions with the Greenback state parties; these fusions affected the independent Greenback vote, and in 1884 its presidential candidate, B. F. Butler, polled only 175,380 votes, a substantial portion of which were cast by the ANTI-MONOPOLY PARTY. Within the next four years the Greenbackers were absorbed by other parties.

GREENBACKS, the popular name for U.S. Treasury notes printed in green on the reverse side, issued during the Civil War to finance the government. The first issue was authorized 1862, to the amount of $150,000,000, in denominations of not less than five dollars; the second in 1862, of another $150,000,000; and the third in 1863, of $100,000,000, bringing the total to $400,000,000.

Greenbacks were LEGAL TENDER in payment of all debts except duties on imports and interest on the NATIONAL DEBT. They served as reserves for the newly established national banks. In 1865 these notes were funded into bonds or redeemed with the proceeds of bonds issues, but in 1868 the popular feeling against contraction of the currency resulted in the prohibition of further redemption, leaving $346,000,000 outstanding and still in circulation. In 1875 a law was passed providing for resumption of SPECIE PAYMENTS, or the redemption of greenbacks in Gold. In spite of several attempts to repeal the law, it was carried into effect. In the national elections of 1876, 1880, and 1884, the greenback party demanded more Greenbacks and the repeal of the resumption act, in order to provide cheap money; later the same party espoused the cause of free silver (*see* BIMETALLISM). The Gold Standard act of 1900, which provided a gold reserve of $150,000,000 for the redemption of greenbacks, put the United States on the gold standard.

Greenbacks were undoubtedly a factor in the rapid rise of prices during the Civil War, and in the social unrest which grew out of that situation. To it may also be attributed the depreciation of paper money, the corresponding premium upon gold, and the increased cost of war supplies. B. H. B.

GREEN BAY, a lake port city in eastern Wisconsin, the county seat of Brown Co., situated on Green Bay of Lake Michigan at the mouth of the Fox River. Green Bay is 114 mi. north of Milwaukee; it is served by bus lines, lake and river craft and three railroads. The city is a shipping point for grain, coal, fish and cheese. The important manufacture is paper. In 1929 the manufactures reached approximately $29,000,000; the retail trade amounted to $24,126,171, automobiles constituting the largest sales. Ten miles from this site was a village of the Winnebago Indians, visited by Jean Nicolet in 1634. Ft. St. Francis was built here in 1718-20; permanent settlers came here about 1745. Green Bay was chartered in 1854 and consolidated with Ft. Howard in 1893. Pop. 1920, 31,017; 1930, 37,415.

GREENBRIER (*Smilax rotundifolia*), a woody prickly-stemmed, perennial vine of the lily family called also horsebrier and catbrier. The climbing stems, often with four-angled branches, bear thick, shining, nearly orbicular leaves, greenish flowers in umbelled clusters and black inedible berries. The plant is common in woods and thickets from Nova Scotia to Minnesota and southward to Florida and Texas. Various other prickly species of *Smilax* are also called greenbrier.

GREENCASTLE, a city in western Indiana, the county seat of Putnam Co. It is situated on the Big Walnut River, 38 miles southwest of Indianapolis, and is served by four railroads. Greencastle has lumber, zinc and steel mills and manufactures cement. It is a transportation center for grain and livestock. DE PAUW UNIVERSITY, founded in 1837, is situated here. Greencastle was founded in 1820, and became a city in 1861. Pop. 1920, 3,780; 1930, 4,613.

GREEN DRAGON (*Arisæma Dracontium*), an interesting plant of the arum family closely allied to the Jack-in-the-Pulpit, sometimes called dragon root. It is found along streams and in wet woods widely in eastern North America. The plant is a somewhat fleshy perennial growing from clustered, very acrid corms. The short, rather weak stem bears a single leaf, 1 to 4 ft. long, divided into many leaflets. Usually concealed by the large leaf is a small greenish or whitish spathe, an inch or two long. This enwraps the base of a flower-bearing spadix which is protruded into a slender tip often 6 in. long. The orange yellow berries, borne in a close cluster, are conspicuous in autumn.

GREENE, NATHANAEL (1742-86), American general, born at Potowomut, R.I., Aug. 7, 1742. He served in the Rhode Island Legislature from 1770 to 1775, and although a Quaker, joined the militia in 1774. He was appointed a brigadier June 22, 1775, promoted to the rank of major-general Aug. 9, 1776, fought at Trenton, Brandywine and Germantown, and was made Commander-in-chief of the Southern Army Oct. 4, 1780. Greene subsequently re-conquered South Carolina, and after the Battle of Eutaw Springs kept Stuart's forces in Charleston until the end of the war. After the war he became a southern planter on lands granted him by the people of Georgia, and in 1785 took over the confiscated land of the loyalist John Graham near Savannah. He died there June 19, 1786. His remains were removed to the Greene monument in Savannah in 1902.

GREENE, ROBERT (1560?-1592), English dramatist, novelist and poet, was born in Norwich, about

1560, and was graduated from Cambridge, 1583. After traveling on the Continent he lived as a man-about-town in London, but was an industrious writer. His novel *Pandosto,* the source of the plot of Shakespeare's *A Winter's Tale,* was extremely popular. In his autobiographical *Greene's Groat's Worth of Wit,* 1593, he calls Shakespeare "an upstart crow." His plays, printed posthumously, include *Historie of Orlando Furioso,* 1594; *Friar Bacon and Friar Bungay,* 1594; *Historie of James the Fourth,* 1598, and *Alphonsus, King of Arragon,* 1599. Several other plays are doubtfully ascribed to him. Greene died in London, probably Sept. 3, 1592.

GREENEVILLE, a city in eastern Tennessee, the county seat of Green Co., situated near the Nolachuckey River, 72 mi. northeast of Knoxville. Bus lines and the Southern Railroad afford transportation. The city is a market for tobacco, poultry and dairy products. The chief manufactures are chairs, hosiery and condensed milk. Greeneville was the birthplace of David Crockett, and contains the home of Pres. Andrew Johnson. Gen. John Hunt Morgan of the Confederate Army was killed in Greeneville. The city is the seat of Greeneville College for Negroes; near by is Tusculum College. Greeneville was incorporated in 1875. The city is a gateway to the Great Smoky National Park. Pop. 1920, 3,775; 1930, 5,544.

GREENFIELD, a town and village, the county seat of Franklin Co., northwestern Massachusetts. The village is situated on the Connecticut River, about 36 mi. north of Springfield. It is served by the Boston and Maine Railroad. There are several manufactures, principally small tools. The factory output of the town for 1929 was about $7,500,000. It is a trade center for a farming region producing fruit, poultry, tobacco and dairy products. A winter sports carnival is an annual event. Greenfield was founded in 1686 and incorporated as a town in 1753. It is situated east of the Berkshire hills and is the terminus of the Mohawk trail. The townsmen took a leading part in Shays's rebellion, 1786-87. Pop. 1920, 15,462; 1930, 15,500.

GREENFINCH (*Ligurinus chloris*), a small bird of the finch family, common in Europe, western Asia and northern Africa, called also the green linnet. It is about 6 in. long, with green and yellow plumage, nesting usually in shrubberies and feeding mostly on seeds, berries and insects. The greenfinch is readily domesticated and learns to imitate the songs of other birds.

GREEN FLASH, in astronomy, the name given to the last rays of the setting sun, which under favorable conditions are green in color.

GREENHEART (*Nectandra Rodiœi*), a fine forest tree of the laurel family, found in tropical America. It grows 60 to 70 ft. high, often unbranched for the first 50 ft., with a trunk 2 to 3 ft. in diameter. The tree is very highly valued for its timber, which is one of the most durable shipbuilding woods, and also for its bark, known as bebeeru bark, used in medicine.

GREENHOUSE, a generic term for various glass structures used in plant growing. It does not include cold frames or hotbeds which are boxes without permanent bottoms or tops, covered with glazed sash and used for growing plants. A greenhouse includes the following principal structures: 1. Conservatory, generally an architecturally ornamental glass structure in which plants usually developed elsewhere are placed for display. It is often attached to the residence. 2. Forcing house, where plants, especially vegetables and strawberries, are grown in advance of or at some other time than normal for the locality. 3. Warm or stove house, the glass house in which the highest temperature is kept in order to meet the requirements of tropical and other heat-loving plants. 4. Propagating pit, a cellar roofed with glass, often also supplied with bench-shelves filled with soil. It is usually a sun-heated general-purpose structure in which plants, especially bulbs, violets and other hardy plants, are started or grown.

Pioneer greenhouses were modified dwelling houses with more and larger windows but with wooden roofs or even living-rooms above them. Glass roofs were substituted about the year 1800, but even until Victorian days these roofs were built with small panes of glass between wooden beams that cast heavy shadows. These greenhouses were usually heated by flues which carried the smoke from stoves at one end to chimneys at the other.

During the last quarter of the 19th century intensive study was devoted to greenhouse construction and management. Experiments were conducted to determine the most favorable tilt of the glass with respect to the sun's rays, to discover the most effective methods of heating and ventilation, the best types of material and methods for constructing walls and roofs, and the proper size of glass panes and rafters. Among these later experiments it is difficult to select the most important, but the most spectacular is the use of structural steel in the construction of greenhouse roofs. Due to this many individual modern greenhouses cover an acre or more and are so high and so free from obstructions that the soil in them is plowed by teams or tractors. Perhaps to this factor more than to any other is due the remarkable development of the cut flower industry and especially vegetable forcing. *See* HORTICULTURE. M. G. K.

GREENLAND, a large island extending from 83° 39′ to 59° 45′ N. lat. and from 17° to 73° W. long. and separated in the north from Ellesmere Island in the Canadian Arctic archipelago by a narrow strait. To the east, beyond the continental shelf, are the deeper waters of the North Atlantic. The island is thus well within the polar regions, about three-quarters of its length lying within the Arctic Circle. Greenland is surrounded by smaller islands and has an area estimated at 827,275 sq. mi. It is a dependency of Denmark. This wedge-shaped island, large enough to rank as a continent, is the most northerly land in the world. The length is about 1,670 mi. and the extreme breadth, at 70° N. lat., is nearly 800 mi.

Its outstanding feature is the inland ice. With the exception of a strip along most of the west coast, a relatively broad strip on the extreme north and a narrow margin on the east, the whole of the island is hidden under ice of great thickness, which forms a gently sloping dome, rising in the interior to a height of at least 9,000 ft. On the lower slopes of the icesheet, summits of mountains project as solitary islands. These are spoken of as nunataks. Deep fiords extend inland for 80 or 100 mi. ending at the foot of glaciers which originate in the central ice cap. These glaciers reaching the water's edge are constantly producing icebergs, and are therefore called discharging glaciers.

From the whole of the island 390 species of vascular plants have been recorded. The tree limit, which is taken as the southern boundary of Arctic vegetation, is close to Cape Farewell, the southern apex of the island; in southern Greenland there are birches, alders and a few other trees, some reaching a height of 12 or 18 ft. Farther north in the region of Disko Island the only trees are scrubby dwarf willows, rarely exceeding three ft. in height, and the dwarf birch. Lichens, white, yellow, grey and vermillion in color, play a prominent part in the landscape and in preparing the ground for higher plants. There are a few ferns, which grow in rock fissures and in favored situations have flowering plants. The monocotyledones give to the Arctic landscape an unexpected brightness; they include several grasses, sedges, rushes and species of pondweeds. On a sunny slope on the shore of Disko there are a few orchids. Vegetables are successfully grown as far north as Umanak, 70° 40′, and flowering plants and ferns have been found in Greenland north of 76° N. lat. In the Disko Bay area iron and coal are found, and graphite is mined near Upernivik.

The animals of Greenland are the musk-ox, polar wolf, lemming, arctic hare, stoat, fox and reindeer, though these last are now scarce. Seals and whales are numerous; sharks, valuable for the oil procured from the liver, are also found. There are important fisheries for cod and halibut. Greenland's natives subsist almost entirely on animal life.

The climate is uncertain and changeable. In Feb. the mean temperature is 36° below freezing point. The mean temperature for July in 69° N. lat. on the west coast is 47° F. Only in July does rain take the place of snow. In the high interior the temperature is always low, ranging from 14° in summer to 90° F. in winter. There are about 20,000 Eskimos, most of whom live on the west coast. A fairly large colony exists a short distance from Cape Farewell on the east coast, and in 1925 one or two new settlements were established in the neighborhood of Scoresby Sound. In addition to the Eskimos there are a few Danish officials. Under Danish rule the condition of the natives has been greatly improved; they can now obtain the necessities of life whether hunting is good or bad.

GREEN MOUNTAIN BOYS. Ethan Allen, having represented his fellow settlers in an unsuccessful suit at Albany, 1771, against the New York claimants to Vermont lands, on his return effected an organization of settlers to evict the New York title-holders. This organization took its name from the Green Mountains of the locality. At the outbreak of the Revolution Allen offered the services of his organization to the Continental cause. The band held the Canadian passes against the British, and won the Battle of Ticonderoga.

GREEN MOUNTAINS, a range belonging to the Appalachian system in eastern United States, and extending north and south through Vermont from Canada to Massachusetts. They have a prevailing height of about 2,000 ft. but at intervals rise much higher. In the southern section are Haystack and Stratton, summits measuring 3,462 and 3,859 ft. respectively; in the central part are Killington Peak, 4,241 ft., Lincoln, 4,078 ft., and Camel's Hump, 4,088 ft., and in the north Jay Peak, 4,018 ft. and Mt. Mansfield, the highest in the range, with 4,364 ft. Just north of the latter is Smuggler's Notch, a canyon 1,000 ft. deep with almost vertical walls of solid rock. Quantities of beech, birch and sugar maples are found on the slopes as well as a dense growth of fir, pine and hemlock from which the mountains take their name.

The range has a 30 mi. spread in southern Vermont, narrows to 1 mi. at Mt. Mansfield, and widens again toward the north. The central and southern sections form the water parting between the Hudson and Connecticut river basins, but the northern portion is cut by the valleys of the Winooski and Lamoille rivers which flow into Lake Champlain. These mountains are important commercially for the production of maple sugar and quarrying of marble. The finest white marble in the United States is found near Rutland, Vt.

GREENOCK, a municipal burgh and seaport of Renfrewshire, Scotland, on the Firth of Clyde, about 22 mi. northwest of Glasgow, and with a water-front of some 4 mi. The town has an average annual rainfall of 64 in. There are many public works and buildings, some associated with James Watt, the famous engineer. Since the opening of New Harbour in 1710, the local shipbuilding yards have turned out some of Britain's largest liners and battleships. Among the manufactures are soap, paper, woolens, marine engines and sailcloth. There are distilleries and sugar refineries located here. Pop. 1921, 81,123; 1931, 78,948.

GREENOUGH, HORATIO (1805-52), American sculptor and author, was born at Boston, Mass., Sept. 6, 1805. He studied with the French sculptor, Binon, attended Harvard, where he met Washington Allston, and also worked with Bertel Thorvaldsen in Rome. His best known work, the much ridiculed colossal statue of Washington as Zeus, 1843, was originally intended for the dome of the Capitol. Greenough executed busts of Henry Clay, Lafayette and other contemporary statesmen and produced some prose and verse. He died at Somerville, Mass., Sept. 13, 1852.

GREEN RIVER, a tributary of the Colorado, rising in Wyoming on the western slope of the Wind River Mountains. It runs southward through Wyoming into Utah and after cutting through the Uinta Mountains, makes an eastward detour into Colorado. Upon reentering Utah it flows southwest and south to empty into the Colorado at the southeast corner of Wayne Co. Much of its course of 425 mi. is through mountainous country. With its tributaries, the Yampa and White on the east, and the Uinta and San Rafael on the west, the Green River drains an area of 41,000 sq. mi. comprising a large part of Wyoming and eastern Utah. There are several irrigation developments on its upper reaches.

GREENSAND. *See* GLAUCONITE; MARL.

GREENSBORO, a city and county seat of Guilford Co., northern North Carolina, situated about 35 mi. east of Winston-Salem, N.C. Bus lines, truck lines, airlines and two railroads serve the city. Tobacco is the principal crop of the vicinity. Greensboro is a textile manufacturing center turning out silk hosiery and cotton products; it also has several large insurance companies. In 1929 the value of the manufactured output was about $38,000,000; the retail trade amounted to $26,663,272. Guilford Battleground, a national park and the scene of the turning point of the American revolution is in the vicinity. O. Henry was born in Greensboro. It is the seat of North Carolina College for Women, the Greensboro College for Women and several Negro colleges. The city was founded and incorporated in 1808. Pop. 1920, 19,861; 1930, 53,569.

GREENSBURG, a city in southeastern Indiana, the county seat of Decatur Co., situated on a branch of Sand Creek, 47 mi. southeast of Indianapolis. It is served by the Big Four Railroad and has various manufactures including lumber products, automobile accessories and shirts. Farming and stock-raising are the chief agricultural interests. Pop. 1920, 5,345; 1930, 5,702.

GREENSBURG, a city and county seat of Westmoreland Co., Pa., about 30 mi. southeast of Pittsburgh on the Lincoln Highway is served by the Pennsylvania Railroad, by motor busses and by a private airport. Its altitude is 1,200 ft. It is in a bituminous coal region and is an industrial, business and residential city. It has railroad shops, produces natural gas and coke and manufactures valves, fittings and steel pipe chiefly. In 1929 aggregate manufactures were valued at approximately $7,000,000; the retail trade amounted to $15,677,942.

Greensburg was founded in 1785 by Gen. Arthur St. Clair, President of the Continental Congress and first governor of the Northwest Territory; it was named after Nathanael Greene, Revolutionary general. The battle of Bushy Run against the Indians was fought here in 1763 under Col. Boquet. The borough was incorporated in 1799. Pop. 1920, 15,033; 1930, 16,508; about 12% foreign-born.

GREENSHANK (*Totanus nebularius*), a well-known Old World species of sandpiper, closely allied to the American yellow-legs. The greenshank is about a foot long, grayish or brownish above, white on the lower back and white below, with conspicuous olive-green legs and feet. Frequenting both seashores and the borders of inland waters in northern Europe and Asia where it breeds, it ranges as far southward as Australia. *See also* SANDPIPER.

GREEN SNAKE, a name which may be applied to any snake whose chief color is green. In the United States two harmless species are commonly known as green snakes. One is the smooth-scaled green snake (*Liopeltis vernalis*), also called the grass snake, found in the East from southern Canada to the Gulf, and as far west as New Mexico. This species is seldom over 20 in. long. Another is the keeled-scaled green snake, or green whip snake (*Cyclephis æstivus*), found throughout the South. This is a slightly larger snake, specimens 33 in. long being not uncommon. It is arboreal in habit. Both green snakes are brilliant green above; the former, however, is whitish below, while the latter is yellowish. Both are insect eaters.

GREENVILLE, a city of western Mississippi, the county seat of Washington Co. It lies on the Mississippi River about 100 mi. above Vicksburg. Two railroads, buses and river steamers provide transportation. Greenville is the trading center and shipping point for the rich cotton, corn, lumber and dairying region surrounding it. Floods caused city-wide distress in 1927. In 1929 Greenville's manufactures were valued approximately at $5,000,000; the retail trade amounted to $9,580,608. During the Civil War the city was burned by Federal troops. Greenville was founded in 1828 and incorporated in 1888. Pop. 1920, 11,560; 1930, 14,807.

GREENVILLE, a city and county seat of Pitt Co., eastern North Carolina, situated on the Tar River, 86 mi. southeast of Raleigh. Two railroads and bus lines serve the city. Tobacco and cotton are the principal crops of the region. Lumber and cotton products are the chief manufactures. The city was founded in 1771 and incorporated the same year. Pop. 1920, 5,772; 1930, 9,194.

GREENVILLE, a city in western Ohio, the county seat of Darke Co., situated on Greenville Creek, 36 mi. northwest of Dayton, and served by three railroads. Greenville is in a grain- and tobacco-growing country, and has various industries including flour milling and canning and the manufacture of stoves, knitted goods and cigars. Gen. Anthony Wayne built a fort here in 1793 and the section was the center of much Indian warfare. Some of the important Indian treaties were negotiated here. Greenville was permanently settled in 1808, and became a city in 1887. Pop. 1920, 7,104; 1930, 7,036.

GREENVILLE, a borough of Mercer Co., in northwestern Pennsylvania, on the Shenango River, about 80 mi. north of Pittsburgh, and halfway between New York and Chicago. It is served by four railroads. The borough manufactures steel cars, tanks and bridges. Dairying and stock-raising form

the chief interests of the region. Greenville is the seat of Thiel College. The site of Greenville was settled in 1798. Pop. 1920, 8,101; 1930, 8,628.

GREENVILLE, a city and the county seat of Greenville Co., in northwestern South Carolina, situated on the Reedy River, about 100 mi. northwest of Columbia. Bus lines, airplanes and five railroads serve the city. Greenville lies at the foot of the Blue Ridge Mountains, in picturesque country. It is surrounded by a large cotton-growing area, and is an important manufacturing center making textiles and clothing chiefly. In 1929 the value of the factory output was about $11,000,000; the retail trade amounted to $22,233,112. The city is the seat of Furman University for men and Greenville Women's College. The town of Pleasantburg was established in 1797, the name changed to Greenville in 1831, and incorporated as a city in 1868. Pop. 1920, 23,127; 1930, 29,154.

GREENVILLE, a city and the county seat of Hunt Co., in northeastern Texas, situated east of the head waters of the Sabine, 52 mi. northeast of Dallas. It is served by four railroads. Greenville is a shipping point and trade market for a wide area raising chiefly cotton. The local industries include petroleum refining, cottonseed-oil milling and railroad shop work. In 1929 the manufactured output was worth about $3,500,000. The retail trade amounted to $7,512,104. The city is the seat of Wesley College. Greenville was founded in 1844 and became a city in 1875. Pop. 1920, 12,384; 1930, 12,407.

GREEN VITRIOL, a term applied to ferrous sulphate, known also as COPPERAS.

GREENWICH, a borough of metropolitan London, England, located on the Thames River. It is notable for the Royal Naval College and the Greenwich observatory. This observatory established the Greenwich meridian as 0° and from this are computed the longitudes used by most geographers. Greenwich time has been adopted as the standard for world time calculations. The earliest records of Greenwich date to the 11th century. The royal family lived here for many years; Henry VIII, Queen Mary and Queen Elizabeth were born here.

GREENWICH, a town in Fairfield Co., in southwestern Connecticut, situated on Long Island Sound, 28 mi. northeast of New York City, served by bus lines, ferries and the New Haven Railroad. The town includes the villages of Cos Cob, Riverside, Sound Beach and six others. It is an attractive and exclusive summer resort and a year-around residential settlement for business people, artists and writers. The town was founded by the Dutch in 1614; the borough was incorporated in 1858 and became part of the town on Jan. 1, 1932. Greenwich is associated with the name of Israel Putnam. Pop. borough, 1920, 5,939; 1930, 5,981; town, 1920, 22,123; 1930, 33,112.

GREENWICH VILLAGE, the artistic or Bohemian quarter of New York City. It was originally a separate town, extending west of Sixth Avenue, south of Greenwich Avenue, and north of Minetta and Charlton Streets. Its Latin quarter character grew out of the adaptation by young artists of the stables in MacDougal Alley for their studios.

GREENWOOD, a city and the county seat of Greenwood Co., western South Carolina, situated 75 mi. west of Columbia. Five railroads and bus lines serve the city. Cotton, corn, dairy produce and poultry are the chief products of the region. The principal industries are cold storage and packing and cotton manufacture. The retail trade in 1929 was valued at $4,839,816. Greenwood was founded 1872, incorporated in 1891, and became a city in 1926. It is the seat of Lander College for Girls, an orphanage and a normal school for Negroes. Pop. 1920, 8,703; 1930, 11,020.

GREET, SIR BEN (1856-), English actor-manager, was born at London, Sept. 24, 1856. He began his career in 1879 and played with MARY ANDERSON and LAWRENCE BARRETT; afterward he organized his own company to play Shakespeare and other classics out-of-doors. These "pastoral" plays proved successful, and Greet toured England and America with them for several years. He was the first to produce *Everyman,* the medieval Morality Play, in modern times, and brought the production to America in 1902. He has trained many actors, including Mrs. Pat Campbell, Edith Wynne Matthison and Sybil Thorndike. In 1929 he played to half a million spectators in America and repeated his visit in 1930-31. He published *Shakespeare a Child Can Read and Act,* 1911.

GREGORIAN CHANT, the comprehensive name for the body of liturgical music gathered together by, and edited under the direction of, Pope Gregory I in the 6th century. Between 3000 and 4000 compositions are included in it. These are now known as examples of Plain Song, having received the title of *cantus planus* about 1400 when the service of the Roman Catholic Church began to feel the influence of contrapuntal music; but before that no such distinguishing title was necessary inasmuch as the entire musical service of the church, the Missal as well as the Breviary, was sung without accompaniment and in unison. The entire service, in other words, was sung in Plain Song.

Exactly how greatly indebted Gregory was to the earlier Ambrosian Chant, which takes its name from St. Ambrose (333-397), is a point which musicographers have not determined. The invention of the plagal modes, for example, which greatly enriched ecclesiastical music by increasing the number of modes to twice their magnitude, is attributed by some scholars to Gregory, by other scholars to a different and less famous origin (*see also* MODE). Such disputes, however, are beside the point, since the matter of chief interest is that the Gregorian Chant and the Plain Song are identical, that this type of music is characterized by being chanted in unison and without any clear metrical divisions, and that most important of all, the melodic outlines of all these chants were determined by those richly varied scales which in music are called modes, either authentic or plagal.

GREGORY, name of 16 popes and an antipope. St. Gregory I, the Great, 590-604, descended from an ancient Roman family, renounced his large fortune, founded seven monasteries, and retired from the world. Sent as an envoy of the Pope to the Emperor of the East, he was elected Pope upon his return. Even the miseries of Rome during the Lombard invasion, when the population was nearly exterminated, enhanced the prestige of the bishop. He made friends with the Lombard rulers, conciliated the Emperor of the East, sent forth missionaries, among them Augustine, who converted the King of Kent. He also maintained relations with the Frankish kings and West Goths. Gregory raised the Papacy to a height it had never reached before, extended and unified the Church, and pointed out the way she took for the next thousand years. He was also a Father of the Church and his writings were voluminous. St. Gregory II, 715-731, worked toward Rome's independence, conflicting with Emperor Leo and restraining the Lombards. He made closer contacts with the Anglo-Saxons and sent out St. Boniface as a missionary to Germany. St. Gregory III, 731-741, excommunicated the iconoclasts, encouraged art and restored the city walls, protecting the city from attacks by the Lombards. Gregory IV, 828-844, protected Rome against the Arabs and aided in the fall of Louis the Pious. Gregory V, 996-999, the first German Pope, great-grandson of Otto the Great, crowned his cousin Otto III as Emperor, hoping with him to rule the world in amity. He was driven from Rome by Crescentius, was later restored, but died suddenly. Gregory VI, 1045-46, purchased the Papacy from Benedict IX, but was deposed and banished to Germany, where he died. St. Gregory VII, 1073-85, the great medieval Pope (known as HILDEBRAND). Gregory VIII, 1118-21, antipope set up by Henry V and excommunicated by Calixtus II in 1121. Gregory VIII, 1187, became Pope in Oct. 1187, but died the following December. Gregory IX, 1227-41, excommunicated Emperor Frederick II for postponing a crusade and made war on him twice, but died as the imperial troops were marching on Rome. Blessed Gregory X, 1271-76, an Italian, as archdeacon of Liége, accompanied Edward, Prince of Wales, to Palestine and was elected Pope. He preached a new crusade, tried to make peace with warring factions and recognized Rudolph of Hapsburg, who was able to restore order. He introduced the conclave in papal elections. Gregory XI, 1370-78, Pope at Avignon, was persuaded by St. Katherine of Siena to return to Rome, where he died the same year. Gregory XII, 1406-17, elected by the Italian cardinals during the Great Schism, did as little as his antipope and was deposed by the Council of Pisa. Gregory XIII, 1572-85, a diplomat and scholar, did much for education and promulgated the Gregorian Kalendar. Gregory XIV, 1590-91, pope from Dec. 5, 1590 to Oct. 15, 1591. Gregory XV, 1621-23, decided doctrinal matters and regulated the papal elections. Gregory XVI, 1831-46, a brilliant linguist and scholar, kind, but reactionary. He had a stormy pontificate, wasted money on buildings, but organized the Vatican Library intelligently.

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GREGORY, ST., OF TOURS (c. 538-594), historian and the greatest ecclesiastical figure of Merovingian times, was born at Clermont in Auvergne between 538 and 543, the son of a provincial senator. Such education as he had was received at the hands of his uncle, bishop of Clermont. His well deserved reputation for piety won him the position of bishop of Tours. As administrator of this important see he cared for the sick and poor, defended the helpless, and jealously guarded the rights of the church, even on occasion defying the commands of King Chilperic. His chief literary monument is the *History of the Franks,* the greater portion of which concerns his own time. Written in very bad Latin, it reflects the culture, manners and morals of the day. From Gregory we get an idea of how the barbarians adapted Roman civilization to their own needs. To him orthodoxy was the test of moral worth; he lauds CLOVIS as an upright servant of God in the same breath as he tells of that monarch's deeds of violence and treachery. Sincere, honest, credulous, Gregory is the chief historical source for his age.

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GREGORY, ISABELLA AUGUSTA, LADY (1859-1932), Irish author and playwright, was born in Roxborough, Co. Galway, Ireland, Mar. 5, 1859. She was one of the founders of the Abbey Theatre, Dublin, and has written, produced and translated many plays. She has also been a writer of essays and books of folklore and early Irish sagas. With J. M. SYNGE and W. B. YEATS, she brought to the theater the Anglo-Irish idiom spoken in the west of Ireland. Her plays include *Spreading the News, The Caravans, The Goal Gate, The Travelling Man* and *The Rising of the Moon.* Lady Gregory died at Belfast, Ireland, May 23, 1932.

GREGORY OF NAZIANZUS (c. 325-c. 390), surnamed Theologus, one of the fathers of the Eastern Church, was born at Arianzus, Cappadocia, about 325. He studied at Athens for 10 years, being a fellow pupil of Julian the Apostate. Leaving Athens in 356, he worked with Basil, and became one of the leaders of the orthodox party in discussions at Constantinople and elsewhere. In 380 he was made bishop of Constantinople, but resigned a year later, returning to his early home, where he ministered to the people in the see of Nazianzus. He left behind him at his death the record of an affectionate, humble prelate, one of the greatest theologians of the early Church, who emphasized the spiritual life as of greater importance than theology. He died about 390.

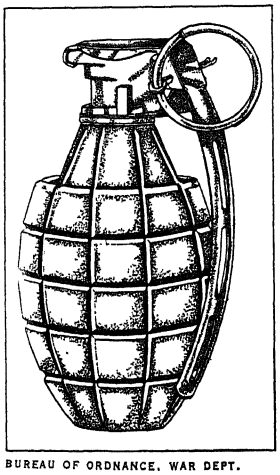
GREGORY OF NYSSA, ST. (c. 335-c. 395), a father of the Eastern Church, was born at Caesarea,

Cappadocia, about 335. He was a brother of Basil the Great, by whom he was made bishop of Nyssa, Cappadocia, in 372. Because he opposed ARIANISM, he was exiled by Valens and was reduced to wandering, but with the accession of the new emperor, Gratian, and the publication of an edict of toleration, he was restored to his see in 378. He died about 395.

GREGORY THAUMATURGUS, ST. (c. 210-270), one of the fathers of the Eastern Church, was born at Neocæsarea, in Asia Minor, about 210. Little is known of his life and his surname, "the wonder-worker," given him on account of the many miracles he is said to have performed, has tended to make him appear almost legendary. He is reported to have met Origen, and delivered in his presence a panegyrical oration, which is among his extant works, together with an epistle and a paraphrase of the Book of Ecclesiastes. He was bishop of his native city and died about 270.

GREIFSWALD, a German city in the province of Pomerania, located on the Ryck River near its mouth. The river is navigable and the city has a harbor. The inner city is bounded by the river on one side and by a wall on the others, the newer parts of the town lying beyond. Noteworthy are churches of the 13th and 14th centuries, the rathaus, late-Gothic houses, a university founded in 1456 and has a large library. There is a dockyard and machine and instrument factories. The place was settled in 1241 by Cistercian monks and was Swedish from 1648 to 1815, except in 1678-79, and has been Prussian since 1815. Pop. 1925, 26,383.

GRENADA, an island of the West Indies, one of the British group known as Windward Islands. It has an area of 133 sq. mi. An irregular mass of volcanic mountains attaining heights of 4,000 ft. cross the island whose surface is rugged The soil, of which one-fourth is under cultivation, is well adapted to the growing of tropical products. Cacao, nutmegs, cotton and mace are the chief products. The manufacture of sugar and rum are major industries. St. George is the capital of Grenada and seat of government for the entire Windward Colony. Columbus sighted Grenada in 1498. The French colonized the island in the middle of the 17th century and kept it till 1762 when it came into British possession. The French regained it in 1779, but ceded it back to England in 1783. Est. pop. 1929, 75,867.



BUREAU OF ORDNANCE, WAR DEPT.

HAND GRENADE, SHOWING SAFETY PIN ATTACHED TO RING

GRENADE, HAND, a small BOMB weighing about one and one-quarter pounds, provided with a short delay fuse of a size to be readily thrown from the hand. Its surface is corrugated to break up the steel case into small dangerous fragments when it explodes.

GRENADINES, a group of islands of the Windward colony in the British West Indies. The group is located between Grenada and St. Vincent and is included partly under the dependency of Grenada and that of St. Vincent. The total area of the group, of which Bequia and Carricou, pop. about 7,000, are the largest, is about 18 sq. mi. The chief products are cotton, molasses and copra. The population is computed with that of GRENADA and ST. VINCENT.

GRENFELL, SIR WILFRED THOMASON (1865-), physician and missionary, was born on February 28, 1865 in Parkgate, Cheshire, England. He studied at Marlborough and Oxford, receiving his M.D. degree from the latter. He was house surgeon at the London Hospital. He fitted out the first hospital ship for the North Sea and did much mission work among the fishermen. In 1892 he went to Labrador as first medical missionary, and there built hospitals and homes for the inhabitants. He cruises about in connection with his missions in vessels he has equipped, and has lectured extensively in Canada, America and England in order to obtain funds. During the World War he was attached as major to the Harvard Surgical Unit in France. He has received many honorary degrees. M.F.

GRENOBLE, a city about 80 mi. by rail from Lyons situated in the foothills of the French Alps and capital of the department of Isère. Grenoble was the chief town of the old province of Dauphiné and gave the title of Dauphin to the heir to the French throne. As an industrial center it is famous for its gloves and as a university town it attracts many foreign students. Pop. 1931, 90,748.

GRENVILLE, GEORGE (1712-70), English statesman, was born at London, Oct. 14, 1712. Grenville, although endowed with apparently every advantage of birth, high moral character, tact and good education, yet ranks as one of the least distinguished statesmen who held high office. He entered Parliament in 1741, occupying successively a number of important posts in the government, becoming prime minister in 1763 and continuing in office until 1765. His reactionary tendencies appear in the prosecution of WILKES and the passage of the STAMP ACT, both of which occurred during his premiership. He died at London, Nov. 13, 1770.

GRENVILLE or GREYNVILE, SIR RICHARD (c. 1541-91), English naval hero, cousin of Sir WALTER RALEIGH. In 1585, he commanded a fleet under Raleigh's patronage, and established the colony of Roanoke, Va. In 1591 he was a vice-admiral under Lord Thomas Howard, and attempted to intercept Spanish treasure ships in the Azores. A superior Spanish fleet appeared and Howard sailed away. Grenville refused to follow and his ship the *Revenge* became separated from the rest of the fleet, was attacked by the Spanish and forced to surrender after

an heroic fight in which he was mortally wounded.

GRENVILLE, WILLIAM WYNDHAM, LORD (1759-1834), English statesman, was born Oct. 25, 1759. Grenville is best known as a determined supporter of Catholic emancipation. This caused him, after long association with PITT, to refuse to join his ministry, when Pitt did not include this measure. Grenville subsequently allied himself with Fox, aiding in the abolition of the slave trade. He was a classical scholar and distinguished himself in literature. He died at Dropmore, England, Jan. 12, 1834.

GRESHAM, WALTER QUINTON (1832-95), American jurist, was born near Lanesville, Ind., Mar. 17, 1832. He was admitted to the bar in 1853. After serving in the Civil War he established a law practice at Albany and in 1869 President Grant appointed him Federal judge of the Indiana district. He resigned this office in 1882 to become Postmaster-general under President Arthur. Two years later he was appointed United States judge for the seventh judicial district. He was the center of a national controversy as a result of his decision in the Wabash Railroad case. In 1884 he served a brief term as Secretary of the Treasury and in 1884 and 1888 was an unsuccessful candidate for the Republican nomination for President. He was Secretary of State under President Cleveland from 1892 until his death at Washington, D.C., May 28, 1895.

GRESHAM'S LAW, a principle applying to the international movement of MONEY from a country which has two kinds of money in circulation, one of greater intrinsic worth than the other. It was formulated by Sir Thomas Gresham. His experience with foreign trade and foreign exchange convinced him that "bad money drives out good," which is the popular simplification of his theory. It is based upon the fact that in international trade the value of coin depends entirely upon its intrinsic bullion value, i.e., upon the amount of gold or silver contained in it, without regard to the nominal value of the coin in its own country, which may be higher than its BULLION value; or on occasion, lower. Those COINS selected for export to pay for purchases abroad, therefore, will be those which have the highest bullion value. Coins which have been mutilated or debased, which were common during Gresham's time, will be left behind as the good coins are drained off—the bad money apparently driving out the good. The same rule applies under modern conditions to irredeemable paper money. *See also* LEGAL TENDER. B. H. B.

GRETA HALL, the home of S. T. COLERIDGE (from 1800-09) and ROBERT SOUTHEY (1803-43), situated on a slope overlooking the Greta River, near the village of Keswick, Cumberland, England. The house contains various relics of the two famous poets. Southey was buried nearby at Crosthwaite Church.

GRETNA, a city in southeastern Louisiana, the county seat of Jefferson Parish, on the Mississippi River, across from New Orleans. Four railroads, river craft and ferries afford transportation. The city manufactures fertilizers, cotton oils, alcohol, slates, shingles, soaps and cooperage. Dairying and farming are also important interests. Gretna was incorporated in 1913. Pop. 1920, 7,197; 1930, 9,584.

GRETNA GREEN, a small village in Dumfriesshire, Scotland, near the boundary line of England. As no license, banns, or priest were demanded in the marriage ceremony of Gretna Green, it was famous for the number of runaway couples, usually minors, who were married there by the blacksmith. Its popularity was diminished in 1856 by new laws. Pop. 1931, 2,857.

GREUZE, JEAN BAPTISTE (1725-1805), French genre and portrait painter, was born at Tournus, in Burgundy, Aug. 21, 1725. After studying under Grandon and at the Royal Academy he made a success with a genre piece, *Le Père de famille expliquant la Bible à ses enfants.* Greuze is noted for his alluring portraits of young girls; his works are light, sometimes artificial, but invariably charming. The *Self Portrait,* in the Louvre, Paris, and *Sophie Arnould,* in the Wallace Collection, London, are especially admirable in line and color. Greuze died in Paris, Mar. 4, 1805, in great poverty.

GREVILLE, FULKE, LORD BROOKE (1554-1628), English poet and courtier, was born at Beauchamp Court, Warwickshire, in 1554. He was educated at Cambridge, and in 1577 went to Queen Elizabeth's court where he gained high favor. He sat in Parliament for several terms, was Treasurer of the Navy, Secretary for Wales for life, and Chancellor of the Exchequer. Most of his writings were published posthumously in 1633, in a single volume. This book included among other works, *A Treatie of Humane Learning* and *A Treatie of Warres.* During his life occasional poems, *The Tragedie of Mustapha* and the *Life of Sir Philip Sidney* appeared. He died Sept. 30, 1628, and was buried at Warwick.

GRÉVY, FRANCOIS PAUL JULES (1813-91), French statesman and President, was born at Mont-sous-Vaudrey, Aug. 15, 1813. He received a classical and legal education, became active in politics and was elected to the Assembly in 1848, but later gave up politics to practice law. In 1868, he again entered politics, eventually succeeding Marshal MACMAHON as President in 1879, and was elected to a second term in 1885. He was forced to resign in 1887, because of the scandal arising from a subordinate selling decorations of the Legion of Honor. He died at Mont-sous-Vaudrey, Sept. 9, 1891.

GREY, ALBERT HENRY GEORGE, 4th Earl (1851-1917), British administrator, was born Nov. 28, 1851. He specialized in law and history at Trinity College, graduating in 1873. A thoroughgoing imperialist, he sat in Parliament as a Liberal from 1880 to 1886. He was against the Home Rule Bill of 1886. Succeeding his uncle as the 4th earl in 1894, he traveled widely in the British Empire. He upheld the policies of CECIL RHODES and in 1895, after the Jameson raid, he was appointed administrator of Rhodesia. In 1904, he was made governor-general of Canada, his term of office being twice

extended, and on his return to England in 1911, he continued in public life, becoming specially interested in agricultural questions. He died at London, Aug. 29, 1917.

GREY, CHARLES, EARL (1764-1845), English statesman, was born at Alnwick, Mar. 13, 1764. Son of a famous Whig family, he became an associate of C. J. Fox, and for many years worked in the interest of the Whig party. In 1807, Grey's father died and, inheriting his title took his seat in the House of Lords. He assisted in having the Catholic Emancipation Bill of 1829 passed, and was active in matters pertaining to parliamentary reform. On William IV's becoming king, Grey was leader of a cabinet which, after many struggles, passed the Reform Bill of 1832. One of the first acts of the Reform Parliament meeting the following year was the abolition of slavery. Many important measures were acted on by the Grey cabinet as education in Ireland, redistributing seats for the House of Commons—but the Irish Coercion Act caused his downfall, and he retired in 1834. He died at Howick, July 17, 1845.

GREY, LADY JANE (1537-54), Queen of England, was born at Broadgate, Leicestershire, England. Her claim to the English crown descended through the female line. Well-educated, she had been brought up by severe Protestant parents. Politically, she was a pawn in a game played by her ambitious elders. Proclaimed queen on the death of Edward VI, London was cold to her. The party behind her fell away, the leaders apprehended, and she was sent to the Tower. Mary, Edward's elder sister, succeeded. Unhappily, Lady Jane's family was involved in a rebellion soon after, and the queen's clemency ended. Lady Jane and her husband were executed, at London, Feb. 12, 1554.

GREY, ZANE (1875-), American author, was born at Zanesville, O., Jan. 31, 1875. He was educated at the University of Pennsylvania and practiced dentistry in New York City for 6 years, after which he devoted his time to writing fiction. His books, based on dramatic events of frontier life in the West, are primarily action and adventure stories but their distinctive features are the remarkable descriptions of the mountains and the plains. The most popular titles include *Riders of the Purple Sage,* 1912, *The Lone Star Ranger,* 1915, *The Thundering Herd,* 1925, *The Vanishing American* and *Fighting Caravans,* 1929. Several of Grey's books were produced in motion pictures.

GREY IRON, a form of cast iron in which much of the carbon is in the free state, its fracture presenting a greyish appearance. Grey iron is quite soft and readily machined, and is extensively used in machine parts. *See also* CAST IRON.

GREY OF FALLODON, EDWARD GREY, 1st Viscount (1862-), English statesman, was born Apr. 25, 1862. Educated at Winchester and Oxford, he succeeded to the baronetcy on the death of his grandfather in 1882 and three years later was elected to the House of Commons as liberal member for Berwick-on-Tweed. His inclinations as a public man were always toward international questions. In the liberal ministry of 1892 he was made Undersecretary for Foreign Affairs, and in 1905 he became Foreign-Secretary, retaining that office until 1916. His conduct of British foreign affairs therefore covers the crucial period during which England gradually abandoned her traditional policy of isolation and her rivalry with Russia and France, for one of close friendship and co-operation with these powers with whom he developed the Entente Cordiale begun by Lansdowne with France in 1904. In place of the old friendship with Germany came rivalry and distrust, especially over naval and commercial matters. The extent to which Grey committed England is a matter of controversy. That he had put England under heavy moral obligations to fight on the side of France and Russia in case of war is clear. During the crucial days of July and August 1914 he made repeated proposals for the peaceful settlement of the difficulties between Austria and Serbia. These failing, Great Britain entered the most momentous war in history under his direction of her foreign policy, when the Germans entered Belgium in August 1914. When Lloyd George came into power 1916, Sir Edward retired and was created Viscount Grey of Fallodon. He came to the United States in 1919 on a special mission and later became active in the interests of the League of Nations. Among the honors conferred on him are P.C. 1902, the Order of the Garter 1921 and the Chancellorship of Oxford University 1928. His published works include: *Fly Fishing,* 1899; *Twenty-five Years, 1892-1916,* 1925, in which he explains his foreign policy; *Fallodon Papers,* 1926, and *The Charm of Birds,* 1927. An unfriendly but searching criticism of Grey's *Twenty-five Years* and of his foreign policy is found in *Lord Grey and the World War* by Herman Lutz, from the German by E. W. Dickes.

GRIBBLE, the common name for a species (*Limnoria lignorum*) of slaters or wood lice (*Isopoda*). It is a minute crustacean, rather like a bug in shape, about ⅛ to ¼ in. long. Gribbles, which are common on the sea coast, are very destructive to submerged wood, as the piles of wharves, into which they bore with their strong jaws. There may be as many as 300 to 400 animals in one cubic inch of wood. They have been particularly troublesome in California. Even when wood has been creosoted the animals may enter at a point where the material was thinly applied, and eat out the heart of the wood, leaving its outer shell intact. Because of this habit they are often not discovered until they have done great damage.

GRIBOYEDOV, ALEXANDER SERGEYEVICH (1795-1829), Russian dramatist, was born at Moscow, Jan. 4, 1795. His dramatic masterpiece, *The Misfortunes of Genius* (1818-23), was a comedy and social satire on Russian bureaucracy. Although suppressed by the government, it passed from hand to hand and made the author famous. Its immortal

characterization of official life in Russia and the vivid picture it offers of the social life of the 18th century in Moscow, cause this play to be still included in the Russian repertoire. Griboyedov's many minor works are of little importance. He died at Teheran, Persia, Feb. 11, 1829.

GRID. *See* TUBES, ELECTRONIC.

GRID LEAK, a CONDUCTOR of high RESISTANCE which permits ELECTRONS collecting on the grid of an electronic tube (*see* TUBES, ELECTRONIC) to flow back to the FILAMENT.

GRIEG, EDVARD HAGERUP (1843-1907), Norwegian composer and pianist, was born at Bergen, June 15, 1843. After studying at the Leipzig Conservatory he worked under NIELS GADE in Copenhagen. In 1867 he founded the Musical Union in Christiania, serving as its conductor until 1880; thereafter he spent most of his life at his country-home near Bergen. In association with Rikard Nordraak he devoted himself to the task of establishing a Scandinavian school of music. In this he was so successful that many of his works, apparently based on folk-songs, are in fact original creations. In addition to about 150 songs his compositions include three violin sonatas, a concerto for the pianoforte in A minor, two elegiac melodies for the orchestra, and two *Peer Gynt* suites, besides many shorter pieces for the pianoforte. He died at Bergen, Sept. 4, 1907.

Grieg did not hesitate to alter the rules of form to suit his own purpose, and his manner of arrangement shows unusual individuality. When following the more classical plan he was not as successful in his music as when developing his ideas according to his own personal preferences. He excelled in composing songs and short, lyrical pieces. His "nationalistic" music, which reflects the beauty and color of Norway, has been greatly admired.

GRIFFIN, also Griffon and Gryphon, an imaginary monster commonly pictured as having the head and wings of an eagle and the body and legs of a



PRECO, HERALD OF TRIUMPH, MOUNTED UPON A GRIFFIN
From a German medieval wood engraving

lion. It figures conspicuously in ancient art, both European and Oriental, and appears frequently in Renaissance paintings and tapestries. In their books of travel, both MARCO POLO and Sir John Mandeville reported the griffin as a real creature, the latter vouching for its existence in Madagascar. Griffin is also a term used by Anglo-Indians to denote a newcomer.

GRIFFIN, a city of western Georgia, the county seat of Spalding Co., situated 40 mi. south of Atlanta. The Central of Georgia and Southern railroads afford transportation. The city is an industrial center, manufacturing turkish towels, hosiery and pimento pepper products. In 1929 the retail business reached a total of $5,435,773. Indian Springs State Forest Park, a government reservation famous for its beauty, lies 20 mi. east. The Georgia Agricultural Experiment Station is located at Experiment, a suburb. Griffin was founded in 1840 and received a charter in 1843. Pop. 1920, 8,240; 1930, 10,321.

GRIFFIS, WILLIAM ELLIOT (1843-1928), American educator and author, was born in Philadelphia, Pa., Sept. 17, 1843. After serving in the Civil War he studied at Rutgers University. In 1871 he went to Japan to establish schools on the American plan, and later was appointed professor of physical sciences at the Imperial University, Tokyo. While in Japan Griffis wrote many articles on conditions in Japan for American newspapers and magazines. He returned to New York in 1874 and from 1877-1903 occupied pastorates at Schenectady, N.Y., Boston, and Ithaca, N.Y. His many works on Japan and other subjects include *The Mikado's Empire,* 1876, and *China's Story in Myth, Legend, Art and Annals,* 1922. Griffis died in Winter Park, Fla., Feb. 5, 1928.

GRIFFITH, ARTHUR (1872-1922), Irish political leader, was born in Dublin, Mar. 31, 1872. He went for a time to South Africa (1896), but, because of homesickness returned to Ireland. Three years later, he founded the United Irishman, afterward called "Sinn Fein" and "Nationality." In the struggle before the organization of the Free State, he was noted for his broad views and his unselfish devotion to his country.

In Oct. 1921 Griffith went to London with other Irish leaders for a conference on the status of Ireland, and after eight weeks signed the treaty establishing the Irish Free State. The treaty was accepted by the Dail and when De Valera resigned as president by way of protest, Griffith was elected president in his stead. In the midst of the unfortunate civil war that ensued, he died suddenly in Dublin on Aug. 2, 1922.

GRIFFITH, DAVID LEWELYN WARK (1880-), American motion-picture director, born at La Grange, Ky., Jan. 22, 1880. He was educated in the public schools, and began his career as a member of J. K. Hackett's company. In 1908 he became interested in motion-pictures, and was made a director of the Biograph Film Co. His technical and mechanical improvements, combined with his skill in obtaining spectacular effects, contributed materially to the growth of motion-pictures in their early stages. His chief silent pictures are *The Birth of a Nation, Broken Blossoms, Intolerance* and *Way Down East.* In 1931 he produced *Abraham Lincoln,* his first sound picture.

GRIFFON, a large vulture (*Gyps fulvus*) found chiefly in the mountainous parts of southern Europe, Asia and northern Africa. It is about 3½ ft. in length with buffish-brown plumage marked with black on the wings and tail. The griffon almost invariably nests on inaccessible rocks, laying usually a single large white egg. Like most other vultures it is somewhat gregarious, feeding upon carrion which it hunts by means of its keen sight.

GRIGNARD, VICTOR (1871-), French chemist, was born at Cherbourg, May 6, 1871. He taught at Besançon in 1905, was professor of chemistry at Lyons in 1908, Nancy in 1909 and since 1919 again at Lyons. His discovery of Grignard's reaction, the combination of organometallic compounds with magnesium, proved of great value in synthetic organic chemistry and brought him, jointly with SABATIER, the Nobel Prize in chemistry in 1912.

GRIGNARD'S REACTION, and Grignard's reagents are the names given to the action taking place and the products formed when metallic MAGNESIUM and certain organic compounds are brought together. They were named after V. Grignard, who in 1900 discovered the peculiar property, apparently possessed by magnesium alone among all metals, of additively combining with such substances as alkyl bromides and iodides. Thus, in the simplest case, the reaction between magnesium and methyl iodide, CH_3I, results in the formation of CH_3MgI, an organometallic compound. The reaction, however, must take place in the absence of water and preferably in ether, since otherwise decomposition occurs. The various groups contained in these complex magnesium compounds appear to be rather loosely connected and possess great facility of interchange with other organic—aliphatic or aromatic—radicals; upon this property depend the importance and the usefulness of Grignard's reagents in organic synthesis, where they are extensively employed to build up complex substances step by step, by means of the constituent groups.

GRIGRA, the name given by the French to a small American Indian tribe which belonged to the Natchez confederacy. Their language and cultural relations are not well known, but their affiliations appear to be with the Tunican linguistic stock.

GRILLPARZER, FRANZ (1791-1872), Austrian poet and dramatist, was born in Vienna, Jan. 15, 1791. Even in childhood he was an omnivorous reader and showed an intense interest in the theater. Before the age of 20 his brilliant mind had experimented with dramatic composition in many directions. His father's death in 1809 left the family without means and the poet supported himself by private tutoring; in the meantime he saturated himself with Greek literature, Calderon and Shakespeare. Grillparzer's first success was the *Ancestress,* 1817, a gloomy tragedy that had an immediate successor in *Sappho,* which continued the tradition of melancholy passion. Then followed a trilogy on classical themes, comprising *The Golden Fleece, The Argonauts* and *Medea.* Nearer home were two patriotic plays of Austria-Hungary and its history: *König Ottokars glück und Ende,* 1825, and *A Faithful Servant,* 1828. Other favorites on the stage are *Waves of Sea and Love,* 1831, a poetical love story, and *The Dream, A Life,* 1835, a dramatic dream of Oriental love and adventure. A German critic has called Grillparzer "the last of the classics and the first of the moderns." Although censorship, critical bickering and neglect embittered his life, since his death a vast literature has grown around his name. Grillparzer died in Vienna, Jan. 21, 1872.

GRIMM, the name of two German brothers, noted as philologists and mythologists. Their fraternal affection was such that they were interested in the same studies and practically spent their lives together.

Jacob Ludwig Grimm, the elder brother, was born at Hanau, Germany, Jan. 4, 1785, and was educated at Cassel and Marburg, and for a short time studied jurisprudence in Paris. In 1808 he became librarian to the King of Westphalia; after 1814 he worked with his brother. He was professor and librarian at Göttingen, and in 1841 he settled in Berlin, where he died Sept. 20, 1863. He early showed a remarkable interest in antiquarian subjects. In 1812-15 he published conjointly with his brother the famous *Kinder- und Hausmärchen,* a collection of German folk tales, universally known as *Grimm's Fairy Tales.* In 1819 he issued his *Deutsche Grammatik,* and nine years later his *Deutsche Rechtsalterthümer;* his most notable later works were the *Deutsche Mythologie,* 1835, and the great dictionary, the *Deutsche Wörterbuch,* 1854. Grimm's *Grammar* ranks as the first outstanding work on comparative Germanic philology, and in this work was formulated the law of the relative correspondence of consonants in Low and High German, known as Grimm's Law.

Wilhelm Carl Grimm was born at Hanau, Feb. 24, 1786. His career followed closely that of his elder brother. His most notable independent work was the *Deutsche Heldensage,* 1829, dealing with the German heroic legend. He had more artistic talent than his brother and undoubtedly did the chief work on the collection of fairy tales. Wilhelm Carl Grimm died in Berlin, Dec. 16, 1859.

GRIMM, FRIEDRICH MELCHIOR, BARON VON (1723-1807), French writer and diplomat, was born in Ratisbon, Germany, Dec. 26, 1723. He was the son of a German pastor, and studied at the University of Leipzig, producing a successful tragedy at the age of 19. Forming an acquaintance with J. J. Rousseau, he participated in the work of the ENCYCLOPÉDISTS, and started a lifelong correspondence with the royalty of Germany, Poland and Russia. In 1775 he was created a baron of the Holy Roman Empire. Grimm's voluminous collection of letters was published after his death, and his correspondence with Catherine the Great of Russia is especially famous. Grimm died at Gotha, Germany, Dec. 19, 1807.

GRIMMELSHAUSEN, HANS JAKOB CHRISTOFFEL VON (c. 1625-76), German author, was

born at Gelnhausen, probably in 1625. While a boy he fought on the Protestant side in the Thirty Years' War. Between 1660-70 Von Grimmelshausen settled at Renchen, Baden, became a local magistrate and apparently a Catholic. About 1658 he began writing, and in 1669 published his famous *Der Abenteuerliche Simplicissimus,* not only an outstanding novel of the 17th century but a matchless picture of the Thirty Years' War. His later works, including the adventures of a feminine counterpart of *Simplicissimus* and numerous satires on the times, never attained the same high level. Grimmelshausen died at Renchen, Baden, Aug. 17, 1676.

GRIMM'S LAW, a PHONETIC LAW, named after Jacob Grimm, its discoverer, who first published it in 1822, describing a series of consonantal changes in GERMANIC as contrasted with INDO-EUROPEAN—often called the "first sound-shift"—and a series of similar later developments in High German as contrasted with the other West Germanic dialects. In the first sound-shift the Indo-European voiceless explosives, both unaspirated and aspirated, *p*(*h*), *t*(*h*), *k*(*h*) become the homorganic spirants *f, th* (as in English *thin*), *ch* (as in German *ach,* Scottish *loch*) as Latin *piscis,* English *fish,* German *fisch.* The Indo-European voiced aspirates *bh, dh, gh* became the corresponding voiced spirants *b* (like *v* in English *love*), *dh* (like *th* in English *then*), *gh* (no equivalent in standard English or German), which eventually changed in most positions to *b, d, g,* as Sanskrit *dhvar,* English *door,* German *tür;* and, finally, the Indo-European voiced explosives *b, d, g* became the corresponding voiceless *p, t, k,* as Latin *decem,* English *ten,* German *zehn.*

The second, or High German, sound-shift developed the *p, t, k* of the first sound-shift to affricatives initially, as well as medially after other consonants or in gemination, written *pf, z* (for *ts*), *kch* (found only in the southernmost Alemannic dialects). Medially and finally after vowels, these sounds developed into spirants, *p, t, k* becoming respectively *f, s, ch,* as Latin *edo,* English *eat,* German *essen.* Similarly, West Germanic *d* became *t,* while the change of West Germanic *th* to *d,* as Latin *tenuis,* English *thin,* German *dünn,* was a later development which extended over Low German dialects as well.

These changes are characterized by a forced utterance which seems to have its counterpart in the fixing of a stress-accent on the first syllable of the word; but no final verdict has been reached as to the underlying causes. The chronology of the shifts is equally uncertain, though the first is known to be far anterior to the Christian era, while the second extended over several centuries, and was complete by the 7th or 8th century A.D. E. Ro.

GRIMSBY, a municipal borough and port of Lincolnshire, England, lying near the mouth of the Humber, 155 mi. northeast of London. Traditionally of Danish foundation, in the time of Edward III it was an important seaport, but fell into decay with the silting up of the river. However, harbor improvements made possible by popular subscription, gave the fishing trade such impetus that by 1800 new docks were necessary, and since then growth has been large and steady. To-day Grimsby has a fishing fleet that sails from the Mediterranean to the Arctic circle with an annual catch of some 180,000 tons. The city possesses extensive docks, a fish market 2 mi. long, and the most modern facilities for icing and quick transportation to consumption centers. It also trades in timber for pit props in the adjacent industrial areas and exports coal. There is regular passenger traffic with Dutch, Danish and Swedish ports. Pop. 1921, 85,827; 1931, 92,463.

GRINDING, in ore treatment, the fine crushing of ore and rock, done in tube or ball mills. Tube mills are horizontal cylinders or cones several feet in diameter lined with silex bricks, pebbles or steel, and partly filled with flint pebbles. As they revolve, the ore fed in at one end is ground by the falling pebbles and emerges at the other. Ball mills have short cylinders, using iron balls for grinding. In very fine grinding, the ore particles are reduced to a size which will permit almost all of them to pass a 200 mesh screen; such a screen has 200 apertures per linear inch. In coarser grinding, the ore may be ground to pass a 20 mesh screen. The degree of grinding depends on the extent to which ore particles are intergrown with GANGUE. *See also* ORE TREATMENT.

GRINDING MACHINES, machines in which the cutting operation is performed by an ABRASIVE. They range from the simplest form of machine in which a spindle carries an abrasive wheel, to the latest types of grinding machines in which the work is automatically ground to the proper size and in which the abrasive wheel is "dressed" with a diamond whenever necessary. In between these extremes are disc grinders, in which the abrasive is carried on a cloth disc cemented to a steel plate; machines using belts covered with abrasives; grinders for finishing flat surfaces from the rough casting; roll grinders; centerless grinders and many others.

Grinding is more and more becoming the finishing operation for many metal parts that were formerly finished by the cutting tools of LATHES, PLANERS, MILLING MACHINES and the like. Grinding gives a more accurate control of size and produces a better finish than is commercially or economically possible by the older methods. But at least one maker of fractional horse-power electric motors prefers to finish shafts with a very light cut from the lathe tool to employing the more usual "grinding" finish.

Two of the later developments are centerless grinding and HONING. In the former the work revolves between the GRINDING WHEEL and two supports, one of which is stationary and the other being an abrasive wheel that does not grind but acts as a guide and revolves the work at the proper speed. This type of machine has been developed to give extreme accuracy at very low grinding costs. Honing is the new method of finishing engine cylinders and other internal work of a similar character. F. H. C.

GRINDING WHEELS, abrasive wheels used for grinding, but not inclusive of the grinding disc and the HONING head. Grinding wheels are made by mixing grains of ABRASIVES with various plastic bonding materials which are hardened in various ways. The vitrified bond is made of fused clay which holds the grains of abrasives very firmly and is unaffected by heat or cold. A softer wheel is made with a silicate bond which is better suited for some work. Thin wheels for cutting and similar work where some elasticity is necessary, are made with a bond of shellac or other gums. Rubber is sometimes used as a bonding material.

The size of the abrasive particles determines the "grain" of the wheel; the kind of bond determines the "grade," or hardness. An ideal bond will hold the grains of abrasives until they become dull and then allow the dull grain to break away and expose fresh, sharp grains. Several varying methods of grading the wheels as to hardness are used by different manufacturers. *See also* GRINDING MACHINES.

F. H. C.

GRINGOIRE, PIERRE (c. 1480-1539), French poet and playwright, also known as Gringore, was born about 1480, probably at Caen, or possibly in Lorraine. Noted as an author and director of mystery plays, he directed a royal fête in Paris in 1501, and soon afterward was chosen "Prince des Sots," or head of the important players' guild, the *Enfans Sans Souci.* For 20 years his productions exercised great influence, and the political, and sometimes anticlerical, issues which he did not hesitate to present, marked him as the originator of political comedy in France. His work also preserves pictures of the bourgeois life of his day. Among his better known productions are *Le Chasteau de Labour* and *La Vie de Monseigneur Saint-Louis par personnages.* Gringoire later became attached to the court of Lorraine, and died there, probably in 1539. *See also* MIRACLE OR MYSTERY PLAY.

GRINNELL, GEORGE BIRD (1849-), American juvenile writer and explorer, was born in Brooklyn, N.Y., Sept. 20, 1849. He was graduated at Yale University in 1870, spent 6 months in the West, then was in business in New York City from 1871-74. He was assistant in osteology at the Peabody Museum, Yale, 1874-80; naturalist with Gen. Custer's expedition to the Black Hills, 1874, and with Col. William Ludlow's reconnaissance to Yellowstone Park, 1874. He was an editor of *Forest and Stream,* 1876-1911, president of Forest and Stream Publishing Co., 1880-1911, and became president of the Bosworth Machine Co. in 1887. Among Grinnell's publications are *Pawnee Hero Stories and Folk Tales,* 1889, *Blackfoot Lodge Tales,* 1892, *Jack, the Young Ranchman,* 1899, *The Indians of Today,* 1900, *American Game Bird Shooting,* 1910, *Beyond the Old Frontier,* 1910, *When Buffalo Ran,* 1920, and *By Cheyenne Campfires,* 1926.

GRINNELL, a city in Poweshiek Co., central Iowa, situated 50 mi. east of Des Moines. Two railroads afford transportation. The city has lumber mills and washing machines and glove factories. GRINNELL COLLEGE is situated here. The city was swept by a tornado in 1882. Grinnell was founded in 1854 and became a city in 1882. Pop. 1920, 5,362; 1930, 4,949.

GRINNELL COLLEGE, a coeducational institution at Grinnell, Ia., organized at Davenport, Ia., in 1846, as Iowa College. The college was removed to Grinnell in 1859, where it was amalgamated with Grinnell University. It is privately controlled, with Congregational affiliations. The name, Grinnell College, was made legally valid in 1909 to prevent confusion with other institutions in the state. The college had productive funds of $2,063,405 in 1931. The library contained approximately 85,000 volumes. In 1931-32 the student enrollment was 687, and the faculty of 68 was headed by Pres. John S. Nollen.

GRIPPE, in childhood. *See* CHILDREN, DISEASES OF: Respiratory Diseases.

GRISELDA, called "the Patient," the heroine of a medieval legend which CHAUCER used in the *Clerk of Oxenford's Tale.* Griselda, put to cruel tests by her husband, bears all trials with exemplary fortitude and patience.

GRISWOLD, RUFUS WILMOT (1815-1857), American editor, was born in Benson, Vt., Feb. 15, 1815. He entered the Baptist ministry, but soon resigned this profession to pursue a literary career. His most important work consists of compilations, such as *Poets and Poetry of America* and *Poets and Poetry of England in the 19th Century.* With JAMES RUSSELL LOWELL and N. P. WILLIS, he was appointed literary executor of EDGAR ALLAN POE, and in 1850 superintended the first edition of his works. Griswold died in New York City, Aug. 27, 1857.

GRIT. *See* SANDSTONE.

GRIZZLY, in ORE TREATMENT, a series of iron bars spaced from one to three ins. apart upon which MINE RUN ore is dumped. The "fines" pass through, and the lump ore which does not is sent to the CRUSHERS.

GROAT, a large coin common in Europe during the Middle Ages. It was made with varying percentages of silver, consequently having various values. The silver groat struck in England was at one time equivalent to four pence or eight cents in United States money; its coinage was stopped in 1856.

GRODNO. *See* GARDINAS.

GROIN, the edge formed by the intersection of two vaulted surfaces meeting each other at an angle. Where the ridges of the intersecting vaults are at different levels, so that the intersection is entirely on one side of the median line of the higher vault, the groin is termed a Welsh groin. The groined vault was apparently first used by the Romans at the beginning of the Imperial age, and its possibilities were rapidly developed by them until the fall of the Empire. It was partially the difficulty of building large-size groined vaults which led to the use of groin ribs in the later Romanesque period, and thus made possi-

ble the tremendous development of the ribbed groined vault which characterized the Gothic period.

GROINS or **GROYNES,** structures extending into a body of water for the purpose of arresting alongshore drift, so protecting or building out the shore

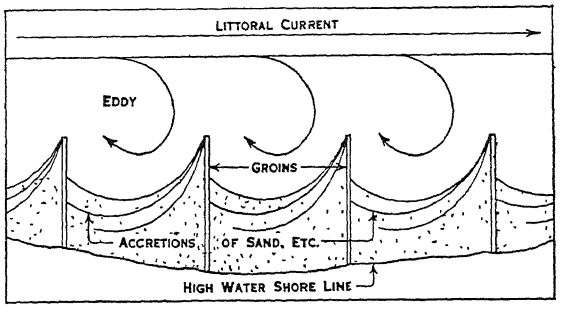


DIAGRAM SHOWING FUNCTION OF GROINS

line. They do not prevent damage or erosion by storm and high water except as they provide a surplus of beach and shoal water to resist periodical storms. Groins keep the scouring current away from the shore and cause comparatively slack water between, which encourages deposition of sediment. They serve a purpose similar to that of "spur" dikes in streams. *See also* SHORE PROTECTION; JETTIES.

GRONINGEN, a Dutch seaport, capital of the province of Groningen, located on the Reit Diep, made by the confluence of two small navigable rivers and united with the Dollart Gulf and the Zuider Zee. A moat surrounds the old city and separates it from the newer sections. The market is the largest in the Netherlands. Among the noteworthy buildings are the Gothic Church of St. Martin, the Catholic Broederkerk, the city hall, and the 17th century university. Groningen manufactures linen and woolen goods, tobacco and cigars, brushes and tiles, books and lithographs and carries on an active trade in grain, rape seed, wool, cattle, butter and cheese. The city was presented by Emperor Henry III to the bishop of Utrecht in 1040; it was one of the Dutch Hanseatic cities, extending its influence to the surrounding Friesland in the 14th and 15th centuries. After protracted wars the city came into the hands of the Duke of Gelderland and capitulated to Charles V in 1536. It has been a city of the kingdom of the Netherlands since 1815. Pop. 1930, 105,303.

GROPIUS, MARTIN (1824-80), German architect, was born at Berlin, Aug. 11, 1824. After a number of years as the designer of private homes he undertook the construction of the great hospitals at Wiesbaden and Berlin and then of the University of Kiel. He later designed the Art School in Berlin and in 1869 became its director. He died at Berlin, Dec. 13, 1880.

GROSBEAK, a name applied to various birds of the finch family (*Fringillidae*), characterized by having a thick strong bill adapted for breaking heavy seeds or the stones of small fruits. They are intermediate between the bluebird and the robin in size, usually with beautiful plumage and often possessing a highly melodious song. The rose-breasted grosbeak (*Hedymeles ludovicianus*), of the eastern United States and Canada, and the black-headed grosbeak (*H. melanocephalus*), of western North America, rank among the finest and handsomest song birds of the continent. Other noteworthy examples are the cardinal grosbeak (*Richmondea cardinalis*), found in the Mississippi valley and Gulf States; the blue grosbeak (*Guiraca caerulea caerulea*), of similar range; the western blue grosbeak (*G. caerulea interfusa*), found from Colorado westward and southward; the evening grosbeak (*Hesperiphonea vespertina*) and the Canadian pine grosbeak (*Pinicola enucleator leucura*), dwelling in coniferous forests from Maine to Alaska and wandering irregularly southward. *See also* CARDINAL.

GROSE, GEORGE RICHMOND (1869-), American educator, was born in Nicholas Co., W.Va., July 14, 1869. He studied at Ohio Wesleyan and at Boston University, and in 1896 was ordained a Methodist Episcopal minister. Until 1908 he filled pastorates in Massachusetts and in 1908 was called to Grace Church, Baltimore, which he left in 1912 to become president of De Pauw University. Grose was made a bishop in 1924 and delegated to Peking, China. His books include *Religion of the Mind,* 1915, and *The New Soul in China,* 1927.

GROSEILLIERS. *See* RADISSON AND GROSEILLIERS, EXPLORATIONS OF.

GROSS. *See* WEIGHTS AND MEASURES.

GROSSE POINTE PARK, a village of southeastern Michigan, in Wayne Co., situated adjacent to Detroit, with which it is connected by street car lines. Grosse Pointe Park is chiefly a residential district of Detroit. In 1929 the retail trade amounted to $2,097,572. The village was incorporated in 1907. Pop. 1920, 1,355; 1930, 11,174.

GROSSETO, a city of Italy, capital of the province of Grosseto in southern Tuscany, in lat. 42° 46′ N., long. 11° 6′ E. It is the seat of a bishop and of technical and other schools. In the old part of the town, surrounded by 16th century walls, is the 13th century cathedral, with a façade of vari-colored marble, and also the 13th century Church of St. Francis, a 12th century abbey, a rebuilt citadel of the Aldobrandeschi and a medieval fortress. The museum contains interesting Etruscan remains, and near the town are the ruins of the old Etruscan city, Ruellae. The chief occupations are cattle-raising, the manufacture of agricultural machines and trade in cattle and lumber. Pop. 1931, 23,997.

GROSSI, TOMMASO (1791-1853), Italian poet and novelist, was born in Bellano, Lombardy, Jan. 20, 1791, and prepared for law at Pavia. His political beliefs prevented him from high accomplishment in the profession, but his reputation as a forceful writer was established when, in 1826, he wrote *I Lombardi alla prima cruciata,* an epic on the Crusades in 15 cantos, after the manner of TASSO. Manzoni praises this poem in *I Promessi Sposi.* In 1834 Grossi wrote

the historical romance, *Marco Visconti.* This pioneer work has been translated into many languages. The author died at Milan Dec. 10, 1853.

GROSSWARDEIN. *See* ORADEA-MARE.

GROSVENOR, GILBERT HOVEY (1875-), American geographer and editor, was born in Constantinople, Oct. 28, 1875. He came to the United States to complete his education, and in 1897 was graduated at Amherst. In 1899 he became associated with the *National Geographic Magazine,* and served that magazine as editor in chief in 1903. In addition he served as director of the National Geographic Society in 1899-1920, and during that time increased its membership from 900 to 1,250,000. Grosvenor is the author of *Flags of the World* and *Discovery and Exploration.*

GROS VENTRE, the name applied by the French to two distinct Indian tribes, in consequence causing much later confusion between the ATSINA, an Arapaho band, and the Hidatsa, or Minatari, or Gros Ventre of the Missouri. The Atsina have been called the Gros Ventre of the prairie and are an Algonkian-speaking tribe that lived on the south branch of the Saskatchewan River in Canada. At the beginning of the 19th century they moved to the Milk River valley in Montana where they now live on a reservation with the Assiniboin. Culturally the Gros Ventre are closely related to the Arapaho and in all their traits are typical of the Plains Indians. They were nomadic hunters, living on the buffalo and its products, and had a series of age societies. They performed the sun dance.

GROTE, GEORGE (1794-1871), English historian and statesman, was born near Beckenham, Kent, Nov. 17, 1794. At an early age he worked in his father's bank, but spent considerable time studying and writing. He was elected three times to Parliament, advocated Parliamentary reform, and was noted for his liberal views. He was active in educational matters, one of the founders of the University College, London, and a trustee of the British Museum. Although the author of many articles to the Edinburgh *Review* and other publications, he is particularly noted for his works on *History of Greece,* and *Plato and the other Companions of Socrates.* Grote died at London, June 18, 1871, and was buried in Westminster Abbey.

GROTESQUE, any fantastic ornament, especially one in which imaginary animals are used, or in which animals or human figures are combined with foliage. The word differs from ARABESQUE in that it connotes ornament which possesses humor, irony, or even savagery and fear. As such it is now chiefly used of Romanesque ornament. (*See* ROMANESQUE ARCHITECTURE.) The history of the word shows other meanings still occasionally used. It was first applied in the early 16th century to a type of Roman stucco relief and painted ornament discovered in certain rooms of Nero's Golden House that formed part of the substructure of later imperial thermae. From their underground position, they were known as grottoes, or caves, hence grotesque. Since these showed frequent decorative uses of the human figure combined with foliage, the name was applied to all ornament with such forms, as well as all stucco and painted ornament based on these Roman precedents, such as the Villa Madama, Rome, by Raphael and Guilio Romano, c. 1525.

GROTH, KLAUS (1819-99), German poet, was born at Heide, Apr. 24, 1819. He became a teacher in the common schools while he undertook to acquire the higher branches of learning through self-study. For 6 years he lived at Fehmarn, where he began the writing of poetry, making use of the Low German dialect. In 1853 he went to Kiel, and 3 years later to Bonn where he was honored for his service in popularizing the Low German dialects. In 1866 he became Professor of German Language and Literature at Kiel. Groth's principal poetic work, *Quickborn,* 1852, shows to great advantage the lyrical effects possible with Low German. He wrote much other Low German poetry and numerous studies in High German on the German language and its dialects. Groth died at Kiel, Apr. 24, 1899.

GROTIUS, HUGO, or Huig van Groot (1583-1645), Dutch jurist, "the founder of international law," was born at Delft, Apr. 10, 1583, of a noble family. He received the degree of doctor of laws from the University of Paris at the age of 15, and at 25, already distinguished, became advocate-general of Holland and Zealand. In that year, 1608, he composed his famous *Mare Liberum,* a dissertation on the freedom of the seas. In 1613 Grotius was named to the judicial position of pensionary of Rotterdam, but soon afterward his participation in political-religious controversy caused his imprisonment. He was sentenced to imprisonment for life and in two years escaped to Paris. In 1625 he completed his greatest work, projected 20 years before, *De jure belli et pacis* (The Law of War and Peace). Unable to return to the Netherlands, he entered the royal service of Sweden in 1631, and during 1635-45 was Swedish ambassador to France. He died at Rostock, Aug. 28, 1645.

GROTON, a town and borough in New London Co., in southeastern Connecticut, situated on the Thames River opposite New London, served by bus lines and the New Haven Railroad. The Groton Airport is situated here. Groton is a residential district, with factories producing chiefly Diesel engines, thread and silk. Many people are also engaged in ship-building and fishing industries. The United States Naval Submarine Base is located here. The Battle of Groton Heights (1781) was fought here. Groton was founded about 1650 and chartered in 1704. Pop. of borough 1920, 4,236; 1930, 4,122. Of town 1920, 9,227; 1930, 10,770.

GROUND CHERRY, the common name for a numerous genus (*Physalis*) of annual or perennial herbs of the NIGHTSHADE family. There are fully 75 species, chiefly American, about 30 of which are found in the United States. A few species are grown for their edible fruits and for ornament. They are sum-

mer-flowering herbs, sometimes slightly woody below, with straggling or creeping stems, soft undivided leaves and axillary, blue, yellow or whitish flowers, often with a darker center. The calyx, which becomes large and bladder-like, encloses a globular yellow or greenish berry, resembling a small tomato. The common ground cherry (*P. pruinosa*), found wild from New York to the tropics, is grown in gardens in the South for its sweetish fruit used for preserves and pickles.

GROUND HEMLOCK, a name widely given in eastern North America to the native species of YEW (*Taxus canadensis*), a low straggling shrub.

GROUND HOG DAY, February 2, the day on which the ground hog or MARMOT is supposed to cease hibernating and venture from his hole. Tradition or superstition has it that if the ground hog sees his shadow at noon on that day he becomes frightened and returns to his burrow and six more weeks of winter ensue. If the day is cloudy at noon, and he does not see his shadow, he remains outside and an early spring follows. The custom of observing the ground hog as a weather prophet is widespread. It is said to have been introduced in America by early German settlers. The original prophet was the BADGER, but he was supplanted by the marmot because the latter is more common.

GROUND IVY (*Nepeta hederacea*), a creeping perennial herb of the mint family, native to Europe and Asia and very widely naturalized in the United States and Canada. It is an attractive plant, often forming dense mats of dark green foliage and bearing numerous crowded clusters of light blue flowers. Because of its spreading habit it is often called Gill-over-the-ground. A variegated form is grown in gardens.



P. A. RYDBERG "FLORA OF PRAIRIES AND PLAINS"

GROUNDNUT

GROUNDNUT (*Apios tuberosa*), a twining perennial of the pea family called also Indian potato and wild bean. It grows in moist thickets and low grounds from New Brunswick to Florida, westward to Minnesota and Texas, and is sometimes planted for ornament. The plant climbs several feet high, bearing divided leaves of 3 to 9 leaflets and clusters of fragrant brown-purple flowers. On the thread-like rootstocks are produced strings of firm-fleshed, starchy, edible tubers an inch or two long, with an agreeable nutty flavor, whence the name groundnut. Various American Indians, especially the Iroquois and Delawares, used the tubers for food, as did also the Pilgrims in Massachusetts, the Swedes on the Delaware and other early settlers of the American colonies.

GROUND PINE (*Lycopodium clavatum*), a trailing species of club moss with long creeping stems and erect branches which bear the spore-producing structures. The name is also applied to the ground-cedar or Christmas-green (*L. complanatum*), which has flattened fanlike branches, and sometimes to the tree club moss (*L. obscurum*). *See* LYCOPODIUM.

GROUNDSEL (*Senecio vulgaris*), a small annual herb of the composite family, sometimes called old-man-of-spring. It is a common weed of cultivation throughout Europe and western Asia, and is widely naturalized in the United States and Canada. The plant grows about a foot high, usually with a very smooth stem bearing deeply cut leaves and numerous rayless flower-heads in terminal clusters. The herbage is believed to be poisonous to various animals.

GROUNDSEL TREE (*Baccharis halimifolia*), a smooth shrub of the composite family called also pencil-tree and cotton-seed tree. It is found along salt marshes and tidal rivers near the coast from Massachusetts to Texas, and also in the West Indies. The shrub grows 3 to 10 ft. high bearing thick, coarsely toothed leaves and numerous flower-heads in crowded clusters. Because of the conspicuous white pappus covering the ripening seeds the plant is cultivated as an autumn ornamental.

GROUND SQUIRREL, a small rodent of terrestrial habits, represented by *Citellus* and allied genera, found in enormous variety in all the open grassy country of the world, and most abundantly in the western half of North America. They vary in size from the little striped chipmunks to big rock-squirrels, 20 in. in length. As their food consists mainly of seeds, nuts, roots, and green vegetation, eked out by mushrooms, insects, and the eggs and young of birds. they flourish in cultivated districts and often become a pest. Their custom of digging burrows and long tunnels is another source of damage to the farmer; extensive measures of repression have therefore been enforced in many parts of the West E. I.

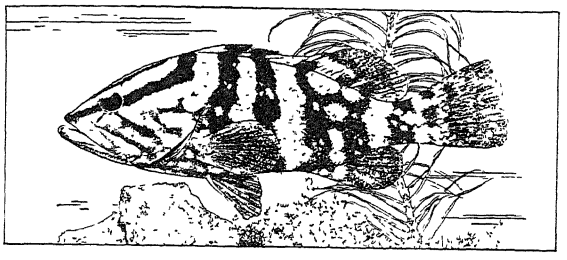
GROUND SUPPORT, in mining, walls or PILLARS of rock or ore which support the ground, or material above the mineral. Rock may be filled into the vacant spaces, but it will not carry any weight until the roof sags onto it. Timber is used, not to support the main roof, but to keep loosened rock from breaking and falling on the miners. Filling by hand or machine is known as "stowing," "backfilling," "gobbing" or "packwalling." *See also* TIMBERING IN MINING.

GROUND WATER. *See* WATER, UNDERGROUND.

GROUND WAVE, direct radiation from a RADIO TRANSMITTER to a receiving ANTENNA, as distinguished from radiation that goes high into the atmosphere and is refracted earthward by the upper ionized layers (*see* HERTZIAN WAVES). No FADING is experienced as long as reception is largely from the ground wave. When the energy arriving along refracted paths is about equal to that in the ground wave, serious fading takes place. The height at which ground waves and

refracted energy are equal marks the boundary of the so-called service area, regardless of the amount of power at the transmitter. *See also* RADIO COMMUNICATION.

GROUPER, a name applied to various sea-basses, common in warm seas. In the main they are large voracious fishes, often brilliantly colored, with flesh of fair quality. Because of their abundance many are valuable food fishes. The red grouper (*Epinephelus*



NASSAU GROUPER (*Epinephelus striatus*)

morio), sometimes 3 ft. long, ranging from Virginia to Brazil, is the most important species found on the coast of the United States. In 1929 the total catch of groupers taken in the southern states amounted to 4,358,000 lbs., valued at $134,000. *See* JEWFISH; SEA BASS.

GROUP INSURANCE, a form of insurance consisting of two main divisions, that of LIFE INSURANCE and that of sickness and ACCIDENT, the former being the most important. It is distinguished from ordinary life insurance in that it applies to a group of industrial workers, usually 50 or more and is arranged for by the employer. It may cover all employees or only certain classes. The premium may be wholly paid by the employer or in part by the employees. Usually no employee is included in the plan until he has been in the service of the employer for a minimum period of time, frequently one year. When the premium is paid both by employer and employee, it is usually a requirement that at least 75% of the eligible employees must apply for the insurance. Unless the employees are in an industry subjected to special hazards, the mortality experience of such a group, representing various ages, approximates the risk found in the normal insurance group, and, therefore, the medical examination is ordinarily waived.

The policy in practically all cases is a one year term renewable contract under which the company is given the contract itself and the employees are given individual certificates. Death benefits are almost always paid in a lump sum, although if total disability payments are provided for, monthly installments are paid in the case of sickness, while in accident group insurance weekly indemnities are paid during the period of disability.

Group insurance may be either participating or non-participating. If participating, its cost may be reduced by the refund of an earned dividend. Likewise, in non-participating policies the company may give annual reductions based on the experience growing out of the number of lives insured in a group, the actual mortality experience of the group and the length of time the policy has been in force. Group insurance, especially if it is life, usually provides that the employee may take additional insurance of a stated amount at his own expense. When an employee is discharged or resigns, his insurance is terminated, although the contract may provide that he may obtain without undergoing a medical examination any form of insurance except term, insurance being at the corresponding premium for his attained age in an amount equal to that held by him in the group policy.

Group sickness and accident insurance is of secondary importance to group life insurance. It covers illness and temporary accident disability. In some cases, it may cover occupational accident hazard in addition, although in no case can such insurance be accepted for compensation insurance where the latter is required by law. The benefits under this type of group insurance may be based upon the length of service, the earnings or as a predetermined fixed amount. The premium on this type of group insurance varies for different establishments, based upon such important factors as the occupational hazard, the number of female employees, the waiting period, and the duration of the benefits. W. F. G.

GROUPS, MATHEMATICAL. Mathematicians are commonly concerned with quantities, but often find it necessary to direct attention to operations. Operations of any given set are said to compose a group if the combination of any two such operations is itself an operation of the set, provided that all combinations are associative and unique. The following examples will serve to illustrate the nature of groups:

1. The numbers 1, -1, i, and $-i$, where $i = \sqrt{-1}$, are such that multiplying any one of them by two in succession is equivalent to multiplying it by a third. For example,

$$1 \times (-1) \times i = 1 \times (-i).$$

2. Suppose the operations to consist in permuting the numbers 1, 2, 3. These operations compose a group, for two successive permutations are equivalent to a third. For example, permuting 1 and 2, then 1 and 3, gives the same result as the permutation which replaces 1 by 2, 2 by 3, and 3 by 1.

As quantities of different things present the same algebra and permit of saying that $2a + a = 3a$ no matter what a is, so different systems of operations may present the same algebra which can be exhibited on abstract operations or elements. This leads to the theory of abstract groups where elements may be interpreted in various ways.

Groups are finite or infinite depending on the number of elements they contain. Every finite group contains the identical element I such that $aI = Ia = a$ for any element a in the group, and contains with a its inverse a^{-1} such that $aa^{-1} = I$.

When a subset of elements in a group forms a group by itself, it is called a subgroup of the group.

To investigate the structure of groups in terms of their subgroups, and the nature of these subgroups, is the main purpose of the group theory.

This theory originated as the theory of permutation groups, and the object of early permutations was the finding of the roots of algebraic equations. This application led to a theory of algebraic equations which is unexcelled in its beauty.

Other operations of importance are linear transformations of which $z' = (az + b)/(cz + d)$ is an example. They compose linear groups applied, for example, in projective geometry.

In the theory of differential equations use is made of continuous groups composed of transformations involving continuous parameters.

From being a fundamental concept of algebra, groups have become a powerful tool of mathematics.

E. D.

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GROUSE, a gallinaceous bird of the family *Tetraonidæ,* differing from the turkeys, pheasants and quail in having their legs partly or completely covered with feathers. The family contains about 25 species in America and other northern countries. Most of them live, find their plant-food, and nest on the ground; but some spend much of their time in the trees of coniferous forests; the ptarmigans belong to the arctic regions and mountain summits. All are of interest and value as game-birds. Of American species, the foremost one is the widely distributed ruffed



G. M. SUTTON, "BIRDS OF PENNSYLVANIA"
J. HORACE MC FARLAND CO. COPYRIGHT

RUFFED GROUSE
Bonasa umbellus unter

grouse, which gets its name from the two broad tufts of black feathers on each side of its neck in sharp contrast to the reddish-brown beautifully mottled general plumage; when the bird bristles with excitement it looks its name. A striking characteristic of this noble grouse is the "drumming" of the cocks as they make the woods resound with the rhythmic beating of their wings. The pinnated grouse, or prairie chicken, once very numerous in the whole Mississippi Valley is now relatively scarce, even in the far West and a relative of which, the heath hen of New England, has lately become extinct, a single example surviving on Nantucket Island until 1931. Among the arid vegetation of the high plains the big sage-hen is still to be found, but is less desirable as a game bird. Other well-known North American grouse are the dusky and Franklin's grouse of the western coniferous forests, the spruce grouse of the Canadian spruce forests, the sharp-tailed grouse of western brush country as far east as Michigan and several species of ptarmigan in the Rocky Mountains and far North. The celebrated Scottish red "grouse" is a ptarmigan, but unlike our American ptarmigan, does not become pure white in winter. Other well-known European grouse are the black grouse and the capercaillie, which is as large as a hen turkey.

E. I.

GROVE, SIR GEORGE (1820-1900), English writer on music, was born at Clapham, Aug. 13, 1820. He was educated as a civil engineer, and aided in the promotion of Crystal Palace, London, of which he was secretary during 1852-73. In 1855 he worked on Smith's *Dictionary of the Bible.* He wrote the scholarly analytical programmes for the Crystal Palace concerts over a period of 40 years. In 1867 he and ARTHUR SULLIVAN made their memorable expedition to Vienna in search of FRANZ SCHUBERT'S missing manuscripts. Their reward was the discovery of many masterpieces. From 1871 Grove worked unremittingly on his *Dictionary of Music and Musicians,* writing numerous articles himself. Although he described himself as musical amateur, his authority and influence were far-reaching. He died at Sydenham, May 28, 1900.

GROVE CITY, a borough of Mercer Co., in western Pennsylvania, situated 23 mi. northwest of Butler. The Bessemer and Lake Erie Railroad affords transportation. Gas engines, truck bodies and machinery are the principal manufactures; other industrial products include furniture, brooms, tools and castings. There is also a creamery, flour mill and foundry. Coal deposits and oil are found in the outlying districts. Grove City College was established in 1876. Pop. 1920, 4,944; 1930, 6,156.

GROWTH, in biology. Living organisms possess the unique and by no means clearly comprehended property, growth,—an increasing of the amount of living substance. This is only possible however when the essential conditions of life are met, such as adequate foodstuffs, water, oxygen and heat. Under these conditions growth may be enormous, as for example, when the human egg (1/125 in. in diameter) during development finally reaches the bulk of the adult body. The ultimate size attained is characteristic for each organism. Growth is thus clearly delimited by unknown factors which appear late in development. Frequently changes accompanying the onset of the reproductive processes seem to be involved. In higher vertebrates later developmental growth is influenced by secretions (hormones) from certain internally secreting glands, particularly the pituitary body, thyroid, and reproductive glands such as the ovary and testis.

While the growth of the body as a whole is under a complex regulation which limits it, it may continue

indefinitely as restitutive growth in epithelial tissue and connective tissues in certain regions, (e.g., in the epidermis of the skin). Restitutive growth may be initiated or accelerated through injury as in the healing of wounds. As regeneration, in many of the lower forms of life it may reinstitute a developmental growth.

Certain embryonic tissues cultivated outside the body in artificial media grow indefinitely, several times exceeding the life-span of the form from which they came. By cuttings, in many plants, growth may be indefinitely prolonged. Usually growth is accompanied by cell multiplication through mitotic division.

N. E. P.

GROZNY, a city in the northern Caucasus of the U.S.S.R., the administrative center of the Chechen Autonomous Area. It is situated on the Sunzha River, near the northeastern fringes of the Caucasus Mountains, on the railroad which runs from Moscow to Baku. In the midst of extensive oil fields, the city has engineering works, oil refineries and sawmills. Among the institutions are a regional museum, a training school for teachers and the Practical Oil Institute. Grozny was established in 1818 as a fort and military center in warfare against the Daghestan mountaineers. Exploitation of the oil wells began in 1883, and although the oil territory is small the wells are most valuable and yield fountain oil remarkable for its proportion of paraffin. In 1928-29 the Grozny trust, or Grazneft, produced 4,367,000 tons of oil. Pop. 1926, 70,896.

GRUBBING. *See* EARTH EXCAVATION.

GRUB STREET, the former name of a street in London, near Moorfields, which was famous for the poor writers who inhabited it; hence a word that refers to literary hacks and hack-work. In 1830 Grub Street became Milton Street, named in honor of the builder and carpenter who was the landlord of the neighborhood.

GRUGRU NUT, the fruit of various species of spiny palms (*Acrocomia*) native to South America and the West Indies, some of which are cultivated. The kernel contains a white crystalline fat called Mocaya oil, resembling cocoanut and palm nut oils.

GRUNDTVIG, NIKOLAI FREDERIK SEVERIN (1783-1872), Danish churchman, poet, historian and educator, was born at Udby, Sept. 8, 1783. He studied at the University of Copenhagen, entered the ministry and eventually attained the rank of bishop. As a clergyman he was an opponent of the rationalism which was then rife in the Danish Church. As an educator he is remembered as the founder of the People's High Schools in Denmark. Grundtvig was an eloquent speaker and a prolific writer in nearly every field of literature. His complete works comprise more than 100 volumes. Among these are *The Mythology of the North, Scenes from the Close of Heroic Age in the North,* Danish translations of Saxo Grammaticus and Snorre Sturlasson, and many volumes of sermons, hymns and poetry. He died at Copenhagen, Sept. 2, 1872.

GRUNDY, MRS., in Morton's play, *Speed the Plow,* 1798, a censorious neighbor who exercises a great power over the mind of Dame Ashfield, causing the latter to ask continually, "But what will Mrs. Grundy say?" The term Mrs. Grundy has since come to stand for conventional propriety.

GRUNEWALD, BATTLE OF. *See* TANNENBERG, BATTLE OF.

GRUNT, the name for a numerous family (*Haemulidae*) of rather small, somewhat basslike fishes allied to the snappers, found chiefly in tropical seas. Most species are of some value for food. They have a compressed, rather deep body, a usually elevated back, and a long dorsal fin. There are many species in the warmer waters of North America; the most abundant is the white grunt (*Haemulon plumieri*), a food fish of importance found from Cape Hatteras to Rio de Janeiro. It is usually less than a foot long, bluish gray in color, with bright blue horizontal stripes on the head.

GRUS (gen. *Gruis*), the crane, one of the more important southern constellations composed of two bright stars of the second magnitude and a string of fainter ones. It is visible from the southern portion of the United States during early evenings in October. *See* STAR: *map.*

GRYPHIUS, ANDREAS (1616-64), German poet, dramatist and scholar, was born in Glogau, Silesia, Oct. 11, 1616, the son of a German pastor. In 1636 he found a friend and patron in Georg von Schönborn, father of the children he was tutoring, and through him gained honors and means sufficient to take him to Leiden, Holland. He remained there for several years, engaged in studying and teaching. Gryphius also lived in France and Italy and finally returned to Glogau in 1647, where he became a respected syndic and wrote plays in his leisure time. He is the author of five tragedies and three comedies, of which the comedies are the more famous. One of these is *Peter Squenze,* adapted from Shakespeare's MIDSUMMER NIGHT'S DREAM. Gryphius died in Glogau, July 16, 1664.

GUACHARO, a remarkable bird (*Steatornis caripensis*), somewhat intermediate between the owls and the goatsuckers, called also oil bird. It is a native of northern South America ranging southward to Peru and Guiana and also to Trinidad. Its length is about equal to that of the crow but in form and plumage it more nearly resembles the nightjars and whippoorwills. Strictly nocturnal in habit, the guacharo sleeps during the day in dark caverns whence it issues at night in vast numbers to search in forests for the oily nuts which constitute its chief food. On ledges or in crevices it builds flattened bowl-like nests of clay in which it lays 2 to 4 white eggs. The nestlings, which become excessively fat, are highly esteemed by the natives for food and also as the source of oil used for illumination and in cookery.

GUADALAJARA, a city of Mexico, capital of the state of Jalisco, situated in the valley of Artemarec at an elevation of 5,200 ft. above sea level, about 275

mi. northwest of Mexico City. Aside from the capital it is the most interesting city in the republic, and has a climate unequalled anywhere. Its inhabitants are of high order, intelligent, alert, well-housed and clothed and very hospitable.

Its industries are textile and flour mills, tanneries, iron works, the manufacture of shoes and hose, and pottery made by Indians in the country nearby. It has street railways and an electric light plant, which receives its power from falls in the Rio Grande de Santiago. It trades in corn, wheat, beans, oranges, hides and cattle. Among the chief buildings are an old mint dating from 1811, a library, high schools, the National College, a University, an Episcopal Seminary and the Hospicio, an asylum for children and the aged and infirm. The massive marble penitentiary is the pride of the city and the government palace, a fortress-like structure was erected by the Spaniards in 1643. The cathedral, begun in 1571, and finished in 1618, was originally of Gothic architecture. It has been partially destroyed by earthquakes from time to time and its reconstruction has resulted in an odd and extravagant medley of many kinds of architecture. It is topped by a Byzantine tower 200 ft. high.

Guadalajara was founded in 1530, and has prospered since the advent of the first American railroad. It was here Hidalgo composed most of his Declaration of Independence, and here Gov. Ramon Corona died from a knife wound, inflicted by a lunatic; Benito Juarez narrowly escaped assassination by revolutionaries; and an important battle was fought here in 1811. Pop. 1921, 143,376; 1930, 182,525.

GUADALAJARA, a city of Spain, capital of Guadalajara province, located on the River Henares. It has interesting churches, an Arabian palace of the Duques del Infantado with a splendid late-Gothic façade and finely appointed pillared court; a theater, military academy and flying field. The city produces leather, flannel and serge goods. Called *Arriaca* in the time of the Goths, it was captured in 714 by the Moors, who gave it its present name. Est. pop. 1929, 13,000.

GUADELOUPE, an island of the West Indies, one of the important French possessions in the Atlantic Ocean. It is formed by two separate islands, divided by a narrow channel known as Rivière Salée, or Salt River. The larger part of the island, or that known as Guadeloupe proper, is about 27 mi. long and 15 mi. wide. Both parts comprise an area of about 600 sq. mi. Guadeloupe is of volcanic origin and is traversed by mountain ridges from north to south. The highest elevation is Sufrière, a semi-active volcano, rising to a height of 5,000 ft. above the sea. The eastern portion of the island, known as Grande-Terre, is generally flat, with the highest elevation only 500 ft. Small streams, which become dry in summer, water the surface. The climate is hot, but not unhealthy. The soil is fertile, the mountains being clad with dense forests.

Bananas, tobacco, Indian corn, sweet potatoes, cocoa and coffee are grown in abundance. Sugar and rum are exported, mostly to France. Basse-Terre is the capital of the island, as well as of the five dependencies comprised by the Guadeloupe colony. Columbus found Guadeloupe in 1493, but it was not colonized until 1635 when the French established a settlement there. Taken by the English in 1759 it was ceded back to France about 1816. Port-a-Pitre at the southern entrance to the Rivière Salée is the largest port. The other islands included in the Guadeloupe colony are Marie Galante, Desirade, Les Saints, St. Barthelemy and part of St. Martin. Their combined area is 688 sq. mi. Pop., 1928, 229,839.

GUADELUPE HIDALGO, TREATY OF, Feb. 2, 1848, an agreement between the United States and Mexico, closing the Mexican War. The American negotiator was Nicholas P. Trist, a clerk in the Department of State, acting upon dubious authorization from President Polk. He met the Mexican commissioners at Guadelupe Hidalgo, a suburb of the City of Mexico. Vigorous opposition in the Senate resulted in certain modifications accepted by Mexico; ratifications were exchanged May 30, 1848. In its final form the treaty established the Rio Grande as the boundary between Mexico and Texas; all Mexican domain (New Mexico, Arizona, Utah, Upper California, and part of Colorado) above the lines of the Gila and Colorado rivers was ceded to the United States in return for $15,000,000; the United States assumed the claims of its citizens for damages against Mexico.

GUADIANA, one of the longest rivers in Spain and Portugal. It rises in southeastern Spain in Albacete province, flows west, partly underground, through marshes and then in a narrow, rocky channel for two-thirds of its length to Badajoz, where it turns south, separating Spain and Portugal for some distance. It empties into the Atlantic Ocean through the Gulf of Cádiz near Ayamonte, Spain. Although the Guadiana drains an area of 31,940 sq. mi. and receives many tributaries along its 500 mi. course, the stream is useless for commercial purposes. Only about 40 mi. are suitable for navigation.

GUAIACOL, monomethyl ester of orthodioxybenzene ($C_6H_4OH\ OCH_3$)1:2. It occurs both as a colorless yellow liquid (with impurities) or as a solid. It is obtained by the distillation of beechwood creosote and comprises that substance to the amount of from 60 to 90%, its taste and odor resembling those of creosote. It is soluble in water (1 in 60) and miscible in alcohol in all proportions. Guaiacol is antiseptic and germicidal; it is used chiefly in forms of its compounds as a so-called intestinal antiseptic and as a bronchial stimulant. It formerly had considerable vogue in the treatment of tuberculosis.

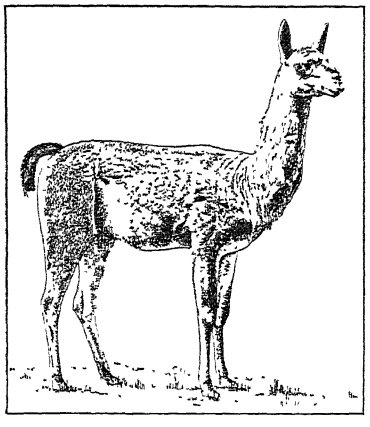
GUAM, an island dependency of the United States, situated at the south end of the Marianne or Ladrone Islands in the Pacific. Its area is 210 sq. mi. The natives, a mixed race with the Malay strain predominating, are called Chamorros. A plateau generally 200 to 500 ft. high occupies the northern half of the island, while the southern part is mountainous.

A coral reef borders the coast. The soil receives abundant rainfall and produces good crops of cacao, coffee, corn, rice, tobacco and coconuts. Exports are limited to copra and coconut oil which are shipped largely to Manila and the United States. In 1930 the total exports were $200,593 of which $187,471 represented 2,376 tons of copra. Imports for 1930 were $603,260.

Piti on the harbor of Apra is the port of entry and Agana is the capital and chief city. The island had, in 1930, 30 public schools with a total enrollment of 3,753 pupils. Guam is an important United States naval station and is administered by the Navy Department. Its governor is appointed by the President and has full executive, legislative and judicial powers.

It was discovered in 1521 by Magellan and held by Spain until ceded to the United States by the Treaty of Paris, Dec. 10, 1898. In 1930 the natives petitioned for United States citizenship. Pop. 1930, 18,509.

GUANACO (*Lama huanacus*), a wild South American representative of the camel family. Although found in Peru, these ruminants occur in the



GUANACO

greatest numbers in Patagonia, usually living in herds of from 5 to 25. The guanaco is larger than its cousin the vicuna, standing 4 ft. at the shoulder, and in appearance suggesting both a camel and a deer. It has a long camel-like neck, and slender legs, the hind pair being noted for two callosities or hairless areas. The long soft fur ranges from fawn-color to almost pure white. Wild guanacos are very shy and difficult to approach, but they are easily tamed. Natives eat the flesh and use the skin for clothing. Guanacos swim readily and according to some writers choose communal places to die.

GUANADINE, a solid crystalline poisonous substance, colorless, deliquescent and soluble in alcohol and water, having the formula $HN{:}C(NH_2)_2$. It is found in sugar beet juice, young vetch plants and the chick embryo. Guanadine has alkaline properties and forms many crystalline salts.

GUANAJUATO, a state of Mexico, situated in the great central plateau, said to be the richest in natural resources of all the states of the republic; area 10,950 sq. mi. The northern part is traversed by the Sierra Gorda Mountains, the central by the Sierra de Guanajuato, and the southern section is a wide fertile plain. The climate varies from cold to temperate according to the altitude. It is rich in deposits of gold, silver, copper and zinc, and is noted for its many mineral springs. Most noted of these is the spring of *Aguas Buenas,* near Silao, which the Indians believe to have miraculous healing qualities. The chief manufactures are leather goods, straw hats, pottery and wines. The capital in Guanajuato; other important cities are Silao, Irapuato, Celaya, and Leon. Pop. 1921, 860,364; 1930, 981,963.

GUANAJUATO or **SANTA FÉ DE GUANAJUATO,** a city of Mexico and capital of the state of the same name. It is situated in a narrow mountain gorge on the Guanajuato River, about 200 mi. northwest of Mexico City, at an elevation nearly 7,000 ft. above sea level. It has street cars, a State college, a theater built of native green stone, an interesting old cemetery above the city on a hill and a mint built in 1812. The surrounding mountains contain silver mines said to be among the richest in the world. Villages built around the openings of these mines are reached by steep, narrow streets, with steps cut out of the solid rock. The Fortress of Alhondiga, made famous during the war of the Castilians against Hidalgo, is one of the famous landmarks of Mexico. Guanajuato was settled in 1554 and incorporated in 1741. It is said that at one time it had a population of 100,000. Pop. 1921, 19,408; 1930, 31,013.

GUANCHE, the ancient language of the CANARY ISLANDS, which became extinct in the 17th century. It is known only from inadequate vocabularies; and inscriptions in the islands in Libyan characters have not yet been deciphered. BERBER elements seem to predominate in Guanche, and it was very probably a Berber language containing many survivals of a language spoken in the Canaries before the arrival of the Berbers.

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GUANO, the excrement of pelicans, cormorants, gannets, penguins, petrels and other sea birds, which is found in large deposits on islands off the Peruvian coast and the west coast of Africa. Because of the large proportion of phosphates and nitrogen, such as ammonium and urate, guano makes an excellent fertilizer. A similar product is the bat guano found in caves of New Zealand.

The use of guano as fertilizer was known to the inhabitants of Peru before the Spanish conquests—probably as far back as the 12th century. Its production and distribution was carefully controlled by the Incas. Guano was first brought to Europe by Alexander Humboldt in 1804, and its value established by his analysis. By the middle of the 19th century it was generally used as a fertilizer in Europe, and within a few decades the deposits were

largely exhausted. The development of phosphate beds in the United States, the Chilean nitrate industry, and the potash developments of Germany—cheaper fertilizers available in greater quantities—also unfavorably affected the guano industry.

The greatest deposits were on the Chincha and Lobos islands of Peru, where layers 200 feet deep were known. Since large deposits form only in a hot climate with little rain, guano is found usually between 10 to 20° north and south of the Equator. Rain dissolves out the ammoniacal salts and nitrates, leaving only the phosphates.

GUANTÁNAMO, a city on the southeast coast of Cuba, situated near the bay of the same name. It is about 40 mi. east of Santiago, and some 15 mi. from Caimanera, its port. The two basins of the harbor are sheltered from storms by the arms of land which form a narrow entrance. It is an important commercial city, and a United States naval base, held under treaty. Among Guantánamo's buildings are an Episcopal seminary and church and a Baptist church. The surrounding district produces limes and coffee, and some fine wood. The city was founded by French refugees from Haiti, and it still has a French atmosphere tempered by American influence. Pop. 1928, 13,464.

GUARANTEE, in law, a promise to answer for the payment of a debt, or the performance of a duty, in case of default on the part of the person primarily liable. By the Statute of Frauds it is required to be in writing signed by the person to be charged.

GUARDIAN, a person to whom the care of the person and property of another is committed. A testamentary guardian is one appointed by deed or will of child's father. A guardian *ad litem* is one appointed by a court of equity to act for an infant in any suit in which he is a party. A person charged with the care and control of idiots and lunatics at common law was styled Committee, the term guardian being applied to one having the care and management of a minor. But guardian is generally coming to be used in a broader sense to cover all cases where one through defect of age, understanding or self control is deemed incapable of looking after his own affairs. Generally the subject is governed to-day by statute.

GUARINI, GIOVANNI BATTISTA (1537-1612), Italian poet, was born in Ferrara, Dec. 10, 1537. He was a professor of literature when 20 years old, and court diplomat when 30. His friendly rivalry with TASSO led him to publish *Il Pastor Fido,* or *The Faithful Shepherd,* 1590, a pastoral tragi-comedy in 15 acts in imitation of Tasso's *Aminta.* This embodiment of the subconscious yearning for the Golden Age has been the inspiration of both CALDERON and PERCY BYSSHE SHELLEY, and has been translated into every European language. Guarini died in Venice Oct. 6, 1612.

GUATEMALA, the northern republic of Central America, bounded on the north and west by Mexico, and on the east cut off from the Atlantic Ocean, except for a few miles of coast line and the seaport of Puerto Barrios, by British Honduras. To the east and south are Honduras and Salvador and on the southwest the Pacific Ocean. Area 48,290 sq. mi. The population in 1921 was 2,119,165, and in 1930, 2,163,546. Some 60% of the population are pure Indians.

The capital is GUATEMALA, pop. 1928, 120,707; it was completely destroyed by earthquake early in 1917, and rebuilding has been slow. Other cities are Quezaltenango, Totonicapán, Coban, Zacapa, Sololá and Antigua (*see* separate articles on these titles). Puerto Barrios and Livingston are the chief ports on the east coast and San José de Guatemala, Champerico and Ocós on the west.

Mountain ranges containing several volcanic peaks run from northwest to southeast near the Pacific. The narrow west slope is the most densely settled section. The rivers are of some importance to the eastern side of the country. Motagua River is 250 mi. long and is navigable for 150 mi. The Polochic is 180 mi. long and partly navigable. The Usumasinta is a fine river but the greater part of its course lies in Mexico. The western slope of the country gives rise to small, numerous and rapid streams. Of the various lakes, Peten, about 27 mi. long, is the principal; on it is the island of Flores, famous for the number of ancient objects of archaeological interest which have been recovered from its soil. The Golfo Dulce, a freshwater lake, is about 36 mi. long and would be one of the finest harbors in the world but for the narrow, tortuous channel through which it communicates with Honduras Bay.

The average rainfall is heavy. The climate is healthy except where the malarial fevers prevail on the coast; in the regions of the interior, because of the elevation of from 4,000 to 11,500 ft. above sea level, it is particularly pleasant. On the plains along the seaboard and in the low-lying, hilly districts there prevails a uniform tropical heat with a mean annual temperature of from 90° to 94° F.

Apart from the insects and fishes, animal life is on the whole comparatively scarce. Game is limited to red deer, peccary, javia, wild turkey and pigeon. Monkeys, however, are fairly well represented, and among them is the little white-faced *Cebus albifrons.* Another member of the family is the howling monkey, *Mycetes stentor,* noisiest of nocturnal animals. The jaguar, largest of the beasts of prey, is not a dangerous animal in Guatemala.

Conspicuous among the forest growths are the mahogany and palms of the lowlands and the pines and oaks of the uplands. One species of oak, which is smaller and much softer than the European varieties, bears acorns as large as turkey eggs. Among the more prominent costly woods are the cedar, a species of palisander, the so-called rose-wood and the *palmolatla,* a close-grained, yellow wood streaked with grey and brown veins.

The soil of Guatemala is largely of volcanic origin and almost everywhere is fertile, yielding products

which vary greatly according to the elevation of the land above sea level. Almost all products of the temperate or tropical regions can be grown to perfection within the borders of the country, from the finest cocoa on the Pacific coast zone and bananas, logwood and mahogany on the Gulf shores, to wheat, potatoes and all kinds of subtropical fruits and vegetables in various parts of the temperate regions. Though rich in minerals Guatemala has but little mining activity owing to transportation difficulties, but petroleum production is on the increase and placer gold mines, silver and salt mines are worked. The principal exports are coffee, bananas, sugar, chicle, woods, cattle, hides, rubber and skins; imports, textiles, machinery and petroleum. About 1925, Guatemala embarked on a program of highway construction.

After the War of Independence the Central American states continued to form part of a single political system, called the Confederation of Central America, from 1821 to 1847. In 1847 Guatemala set itself up as an independent republic, but its present constitution dates only from 1879, and has since been modified several times. It provides for a legislative National Assembly, a President and a Council of State. Politically, Guatemala is divided into 22 departments. Pop. 1930, 2,163,546.

History. PEDRO DE ALVARADO, dispatched by HERNANDO CORTES from Mexico into Central America in 1523, founded Guatemala City in 1524 at the completion of his conquest. All the territory now divided among the Central American countries was during the Spanish colonial era administered as the captaincy general of Guatemala. In Sept. 1821, stimulated by the overthrow of Spanish rule in Mexico, a revolutionary junta at Guatemala City raised the standard of independence. The province of Guatemala, unlike the other provinces of the old captaincy general, readily accepted the invitation of Iturbide to become a part of Mexico. With the collapse of Iturbide's empire, the province became one of the United Provinces of Central America, the confederation which was organized at Guatemala City, June 23-July 1, 1823. The capital was located at Guatemala City; Guatemala was allotted the largest number of delegates in the congress of the United Provinces, and dominated the union to the dissatisfaction of the other members.

Rafael Carrera, leader of a pro-clerical revolution which seized control of the Federated Government in Feb. 1838, became dictator of Guatemala when the federation dissolved into the pre-existing provinces. Carrera, reactionary and headstrong, was the first of a series of dictators who dominated the political history of Guatemala. These dictators were usually constitutional presidents, but invested with great authority and bolstered by a large standing army. Carrera's death in 1865 was followed by an increase in strength of the Liberals, their strongest leader, Justo Rufino Barrios, headed a successful revolution in 1871, and set about the economic advancement and educational improvement of the population, objectives neglected by Carrera. Anti-clerical legislation and the adoption of a liberal constitution marked his régime. Barrios died in battle, Apr. 2, 1885, when attempting to reestablish a Central American union by force. After a period of comparatively frequent governmental changes, in 1898 Manuel Estrada Cabrera established a military despotism which was maintained until 1920. The subsequent succession of executives has had to cope with the damages wrought by earthquakes and to meet imperative problems of finance and education.

For bibliography *see* COSTA RICA: *History.*

GUATEMALA, the capital of the republic of Guatemala, situated 4,877 ft. above the sea on an isolated tableland 75 mi. from San José, the Pacific port. This is the third city of Guatemala that has been destroyed by earthquakes. La Vieja, the Old Town, was ruined in 1541; then a shift was made to a safer position a little farther north. This capital was named La Antigua and was destroyed by the disastrous earthquakes of 1773. The site of the new capital, 25 mi. northeast of Antigua, was chosen because of its being nearly surrounded by deep ravines which were supposed to break the force of earth tremors. For nearly a hundred years this theory seemed correct, although there have been greater or lesser temblors every year. A destructive one occurred in 1874, and at the end of 1917 a series of shakes and shocks, lasting for four or five weeks and ending early in 1918, wrecked the city. Since then the capital has been slowly rebuilt, until to-day, circled by picturesque hills and volcanoes, modern Guatemala is perhaps the most important city of Central America. The city is a trading point for Guatemalan coffee, has a brewery and soap, furniture and cigar factories. Reinforced cement houses have risen upon the old foundations; there are new hotels, churches and government buildings. In the center of the city is the Plaza de Armas, celebrated in Central American history. Perhaps the most noted structure is the university, established in 1910, which has a reputation all over Central America. The capital is said to have been noted for its learning before any educational institution had been established in the United States. Schools of medicine and pharmacy, arts and trades, and a polytechnic institute are in the city. Pop. 1928, 120,707.

GUAVA (*Psidium Guajava*), a shrub or small tree of the myrtle family native to tropical America, extensively cultivated for its delicious fruit. At the time of the Spanish discovery the guava was commonly grown from Mexico to Peru. By cultivation it has since become widely diffused in warm climates, including Florida and southern California. The tree, sometimes 25 to 30 ft. high, bears smooth oval leaves, white flowers, an inch across, and somewhat globular or pear-shaped fruits 1 to 4 in. long. The fruit, which has a musky odor, is composed of a thin yellow skin surrounding a sweet or slightly acid flesh. Guava jelly is an important export from the West Indies.

GUAYAQUIL, the main commercial city and port of Ecuador, situated in the valley of the River Guayas,

about 30 mi. from its mouth. It is the republic's most important port, though its activity has been hindered by the unhealthfulness of the site. To-day conditions are considerably bettered. The entrance to the port is by way of the Jambeli Channel. Guayaquil is accessible by ordinary ocean steamers drawing 22 ft. of water. Larger vessels anchor at Puna and transfer passengers or cargo to boats or lighters. Dredging of the river has taken place and larger steamers can reach the city, which is on a low plain with a salt estuary at the back.

Founded in 1535, Guayaquil has suffered many calamities. It has been sacked by buccaneers, and damaged by conflagrations and earthquakes. It was a center of plague and fever. But to-day the pestilence has been eliminated and the traveler may now find a modern, well-paved city with all improvements.

The whole city is straggling and spread-out, but fine buildings have recently been erected. The modern municipal library and museum is handsomely housed. There are several manufacturing plants for local needs and a shipyard where vessels are built or repaired. Through Guayaquil, Ecuador does almost all her import and export trade. Cocoa-beans, ivory-nuts, rubber and fruits are shipped, and machinery, automobiles and other products are imported. Est. pop. 1931, 130,000.

GUAYULE (*Parthenium argentatum*), a valuable rubber plant native to northern Mexico and extending into western Texas. It is a small, much-branched shrub of the composite family, growing about 3 ft. high, with narrow, silvery leaves and numerous white, long-stalked flower-heads. The dried stems yield about 10% of rubber. While the large balls used by Mexicans in the very ancient game pelota were made of guayule rubber, it was not produced on a commercial scale until about 1900. During the period 1905-09 about 40 million pounds of guayule rubber were exported from Mexico. Later, chiefly because of East India rubber competition, exports declined.

GUBEN, a Prussian industrial city in the state of Brandenburg, situated on the Neisse River about 27 mi. south of Frankfurt. It has a flourishing textile industry, paper factories, saw mills and soft coal mines; it is an important center of German wool, felt-hat and clothes industries. First mentioned in 1207, Saxony ceded it to Brandenburg in 1304 and it became Bohemian in 1368. In 1462 it was returned to Brandenburg by Bohemia. After 1635, it belonged to the Saxon Electorate, but fell to Prussia in 1815. Pop. 1925, 40,602.

GUDGEON (*Gobio fluviatilis*) a fresh water fish of the CARP family, found along the sandy bottoms of European and Asiatic streams, where it feeds on mollusks and small water animals. The gudgeon's body, about 8 in. long, is covered with small scales and is brown above spotted with black, and white below. There is a barbel on each corner of the mouth. The gudgeon is an excellent food fish, easy for fishermen to catch in large quantities, since it usually swims in shoals with many other gudgeons.

GUDRON or **KUDRUN,** in Scandinavian mythology, daughter of King Hettel of Hegelingen (Friesland). She was heroine of a Middle High German, 13th-century epic, which dealt with the legends of the North Sea coast.

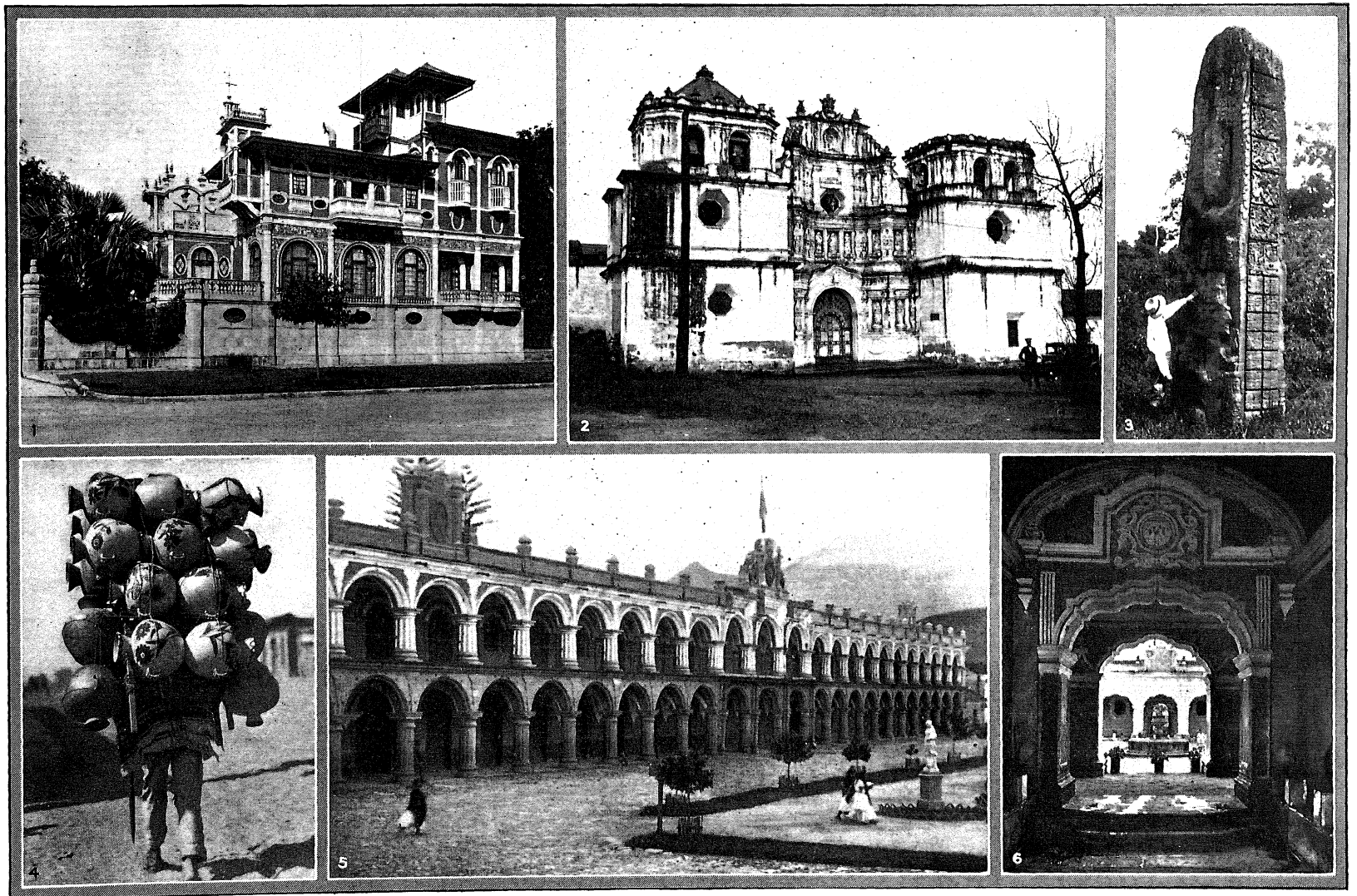
GUELDER ROSE, a name given to the Old World cranberry-tree (*Viburnum Opulus*), and to its widely cultivated variety (var. *sterile*) more commonly known as the SNOWBALL.

GUELPH, a city in Wellington Co., Ontario, Canada, situated on the Speed River, about 50 mi. west of Toronto. Served by the Canadian Pacific and Canadian National railroads, it is the exporting center for the grain, live stock and fruit of the agricultural section. Flour, carpet, woolen, and saw mills and numerous other industries, including the only linen manufacture in the Dominion of Canada, are supplied hydroelectric power derived from the Niagara River. A substantially built city of many public buildings and works, Guelph numbers among its educational institutions the Ontario Agricultural College with an enrollment of some 1,700 students. Founded by John Galt for the Canada Land Company in 1827, and named after the British reigning family, Guelph was incorporated as a city in 1879. Pop. 1921, 18,128; 1931, 21,068.

GUELPHS and GHIBELLINES, the names of the papal and imperial parties in medieval Italy. Originally the names designated German family factions: Guelf, from Welf the family of the Dukes of Bavaria; Ghibellines, perhaps from Waiblingen, the seat of the Hohenstaufens. Long after the strife of Pope and Emperor had ceased in Italy the names were retained as factional designations. *See* DANTE; LOMBARD LEAGUE.

GUENON, a monkey of the African genus *Cercopithecus,* which embraces about 40 species (several known by separate names) much varied in hair-adornments and color-patterns. All are tropical, forest-dwelling, slender creatures, with very long tails and large cheek-pouches, subsisting mainly on fruit and leaves. Among the best known species, each confined to a limited district, are the green monkey, the greenish grivet and vervet, the pluto, the foxy red patas, the mona and the diana. The last two are distinguished by snowy fronts and chin-beards; but nearly all guenons are dressed in gay colors, and are the most ornamental of all monkeys. They are docile, and commonly exhibited in menageries. E. I.

GUEREZA (*Colobus occidentalis*), one of the thumbless monkeys inhabiting Abyssinia and Somaliland southward to Mount Kilimanjaro and westward to Lake Albert Nyanza. In its contrasted black and white fur it looks as though handsomely clad in a two-part robe. The glossy, jet-black parts on face, shoulders, limbs, and upper tail are short-haired, while on the back and hanging from it is a long-haired, silky, white mantle, which flaps like wings when the monkey leaps from tree to tree. The tail ends in a large white tuft, and the black of the face is white-whiskered and white-framed. It is one of the larger



1, 2, 6, COURTESY GRACE LINE; 3, 5, UNITED FRUIT CO.

ANCIENT AND MODERN CIVILIZATION IN GUATEMALA

1. Residence of the Haitian consul, Guatemala City. **2.** Cathedral de Ciudad Vieja, Antigua. **3.** Primitive sandstone monolith in the Mayan ruins of Quirigua. **4.** A pottery vendor on his way to market. **5.** Headquarters of the Spanish conquerors, built in 1526, at Antigua. **6.** Portico of the University of San Carlos Boromeo, Antigua.

monkeys, not very numerous, as the natives have hunted it remorselessly for its hide used in battle costumes. Nor does it thrive long in captivity. Guerezas live exclusively in trees.

GUERICKE, OTTO VON (1602?86), German physicist, was born at Magdeburg, Nov. 20, 1602. Although trained for the law he became a mathematician, physicist and engineer. He was building master of Magdeburg in 1627. He survived Tilly's sack in 1631 but left the city to go into the service of Sweden until 1646, when he returned to Magdeburg as burgomaster. In 1650 he discovered the material nature of the air through the invention of the vacuum pump, making a celebrated demonstration before the diet of Regensburg in 1654. He formulated the basis of the laws of gas pressure and temperature, established the connection between atmospheric pressure and storms, and built the first barometer. He worked upon electrical phenomena, discovering conduction of current and electric sparks. Most of his discoveries he described in his *Experimenta Nova*. He also wrote *The History of the Siege Capture and Sack of Magdeburg*. He died at Hamburg, May 11, 1686.

GUERILLA WARFARE, warfare in which the forces of one or both sides consist of small and loosely organized bands which take advantage of cover, shun engagements in the open and strike opposing forces from ambush. Guerilla tactics obey few of the principles of warfare in the ordinary sense.

GUERNSEY, the second largest and most western of the Channel Islands, lying 48 mi. off the north coast of France, and about 68 mi. from Devonshire in the south of England. It is of a triangular form, about 9 mi. long and 3 to 4 mi. broad. The northern part is level and the southern hilly; the coast is lofty and abrupt, the island being almost entirely of granite formation. The climate is healthy and attracts invalids from England. The principal export is cattle, the dairy cows being renowned and found in almost every country; early spring fruits and vegetables are shipped to the Covent Garden market, London. Guernsey dialect is the pure Norman of some centuries ago; but a knowledge of English is general. The chief educational institution is Elizabeth College at St. Peter's Port, the capital and the only town on the island. Steamers ply regularly between Guernsey and the ports of southern England. The island is under a governor, who represents the sovereign in the assembly of the states, a kind of local parliament. Pop. (with associated islands), 1921, 40,529; 1931, 42,606.

GUERRERO, a state in southwestern Mexico, situated on the Pacific coast, and broken by lofty rugged mountains, principally the Sierra Madre del Sur. The mountains are covered with unexplored tropical forests of great value and interest. It has an area of 25,279 sq. mi., and a mean temperature of 90° F. The partially explored caves of Cacahuamilpa are the largest in Mexico, and similar in formation to the Mammoth Cave of Kentucky. The most important river is the Balsas, which crosses the state to penetrate Michoacan and finally enters the Pacific. Granite, marble, opals and topazes are found in Guerrero, and there are some important pearl fisheries along the coast. The principal products are bananas, oranges, guavas, lemons and an almost endless variety of other tropical fruits, while coffee, sugar cane, sesame, tobacco and indigo yield an abundant harvest. The rich mineral deposits of the state are undeveloped, and only need capital to bring out their treasures. The capital is Chilpancingo and other towns are Tixtla de Guerro, Iguala and Acapulco. Pop. 1921, 566,836; 1930, 637,530.

GUEST, EDGAR ALBERT (1881-), American poet, was born in Birmingham, England, Aug. 20, 1881, and was brought to America in 1891. He had a common school education at Detroit, Mich., and in 1895 became associated with the Detroit *Free Press*. Later he conducted a column of verse in this newspaper, much of which was his own. Guest's poems won wide public favor and were syndicated in many of the daily newspapers. They are collected under the titles *Heap o' Livin', Just Folks* and others.

GUGGENHEIM, JOHN SIMON, MEMORIAL FOUNDATION, an American foundation established in 1925 by Mr. and Mrs. Simon Guggenheim "to improve the quality of education and the practice of the arts and professions in the United States, to foster research, and to provide for the cause of better international understanding." The Foundation offers a limited number of fellowships of about $2,500 each and tenable abroad under the freest possible conditions, for research in any field of knowledge and for creative work in any of the fine arts, including music. The Foundation also grants Latin American exchange fellowships to citizens of Argentina, Chile, Cuba, Porto Rico and Mexico for work in the United States; and to citizens of the United States for work in Latin America. No age limits are prescribed, but appointees must be old enough to have shown marked ability in their particular subject. Among those who have received Guggenheim fellowships are Arthur H. Compton, winner of the Nobel prize for Physics in 1927; Stephen Vincent Benét, author of *John Brown's Body;* Paul Green, playwright and author; Bernadotte Schmitt, Pulitzer prize winner in History for 1931; and George Antheil, composer. H. A. M.

GUIANA, three small European colonies on the north coast of South America: British, Dutch and French Guiana, with a combined area of about 178,511 sq. mi. Rising toward the interior, the alluvial stretch grades into a forested zone of sand and clay hills which parallels the coast from a small number to 50 mi. inland. The land gradually rises into the rolling plateaus of the south, culminating in the Tumac-Humac Mountains at the south and Mt. Roraima at the west. Though many large rivers tap the interior they are all interrupted by falls or bars. Est. pop. 508,000. *See* BRITISH GUIANA; DUTCH GUIANA; FRENCH GUIANA.

GUIBERT or **WIBERT,** of Ravenna (c. 1030-1100), called Clement III, was antipope from 1080

to 1100. He was born at Parma of the Corregio family, about 1020 or 1030. Made chancellor by the Empress Agnes, in 1057, he became imperial vicar of Italy. In 1073 he was chosen archbishop of Ravenna. He took sides against Gregory VII in his disputes with the emperor and was excommunicated, probably at Worms in 1076. The Emperor Henry IV gathered 30 bishops at Brixen in 1080 and elected Guibert Pope in Gregory's place. He was installed four years later and the following Easter crowned Henry and Bertha at St. Peter's. Guibert was, however, driven from Rome in 1097 by the Crusaders and died at Civita Castellana in 1100.

GUICCIARDINI, FRANCESCO (1483-1540), Italian writer and diplomat, was born at Florence, 1483. His many diplomatic posts and missions gave him unequaled opportunities to penetrate the political corruption and unprincipled motives of potentates and popes. One of the keenest historical analysts of all times, a political theorist comparable only to his friend Machiavelli, his works form a library of political philosophy. Among these are the *Storia d' Italia,* 1561-64, and his *Opere Inedite,* 1857-67, containing "Ricordi Politici," aphorisms on politics; *Reggimento di Ferenza, Dialogo del,* 1522-27, a treatise on the Italian states, and the *Storia Fiorentina,* 1509. Guicciardini died at Florence, 1540.

GUIDO D'AREZZO (c. 995-c. 1050), monk and musician, was born in Arezzo (whence his name) about 995. A Benedictine monk in the Monastery of St. Maur des Fosses, he was invited to Rome in 1022 by Pope Benedict VIII, who, having heard of Guido's musical theories, wished to place them at the service of the Church. Two years later Pope John XIX called him again to Rome for the same purpose. Musicographers dispute the precise contribution made by Guido, but agree generally that the four-line staye grew under his hand. He borrowed the two colored lines already serving as a primitive stave and added two more lines of his own, making a valuable contribution to music but less than extraordinary in view of the prior experiments of HUCBALD. He died about 1050. *See also* NOTATION and STAFF.

GUIDO RENI (1575-1642), Italian painter, was born at Calvenzano, near Bologna, Nov. 4, 1575. After studying at Bologna, he went to Rome with Annibale Carracci, whom he assisted in decorating churches and palaces. A man of great vitality, Reni produced numerous religious and mythological works, distinguished by fine draughtsmanship and color which made him the most sought after artist of his time. He painted in different styles, at first in the somber manner of Caravaggio; during his stay in Rome his compositions became decorative, as in the *Aurora,* his greatest work, in the Rospigliosi Palace. His later work, idealistic in conception, thin in treatment and silvery in tone, is well represented in the *Niobe.* After 20 years in Rome, he returned to Bologna where he lived in sumptuous style. But extravagance and a love of gambling brought on disaster, and the end of his life was spent in misery. When he died, however, on Aug. 18, 1642, Bologna gave him a magnificent funeral and a tomb in the church of San Domenico.

GUILDFORD, the county town of Surrey, England, pleasantly situated in the northern chalk downs on the river Wey, 29 mi. southwest of London. Once among King Alfred's possessions, it is a venerable town, with its steep High Street and picturesque gabled and latticed houses. The ruins of a Norman castle stand in grounds that are now gardens, and there is the much restored, Norman and Early English Church of St. Mary. Among other ancient buildings are Archbishop Abbot's hospital, 1619, a 16th century grammar school and a guildhall of the following century. Pepys in his journeyings between Portsmouth and London invariably paused at Guildford, and Lewis Carroll (C. L. Dodgson), of *Alice in Wonderland* fame, is buried in the cemetery. Modern Guildford has mills, iron foundries, a large grain trade, and holds livestock fairs. Pop. 1921, 25,489; 1931, 30,753.

GUILDHALL, THE, the city hall of London, England, officially the Council Hall of the Corporation of the City of London, in Guildhall Yard, Cheapside. It was built in 1411-35 and is a good example of the Perpendicular style. After the Great Fire, 1666, it was restored by Wren; the south front was rebuilt by George Dance, Jr., in 1789; again the building, including the timber roof, was restored in 1864 by Sir Horace Jones; and the south porch was rebuilt in 1909 by Sidney Parks. The Great Hall, 152 ft. long, 48 ft. broad and 89 ft. high, contains various busts, memorials and banners, and is used for the election of the Lord Mayor and other officials. Since 1500 the Lord Mayor's annual banquet has taken place here. The crypt beneath the Great Hall dates from the 15th century. Other important rooms are the Common Council Chamber, 1884, the Aldermen's Court Room (17th century), and the New Court Room, 1908. The Guildhall Museum contains antiquities of Roman, Saxon and medieval times. In the Library, founded in 1828 and opened to the public in 1873, are about 200,000 volumes and many valuable manuscripts. The Corporation Art Gallery is noted for its collection of 19th century British paintings.

GUILDS, an indefinite term applied to associations of individuals for commercial, professional, religious, or other purposes. They existed in ancient Egypt, Assyria, China and the Roman Empire, as well as in medieval and modern Europe. Most important were the medieval commercial guilds in Europe. Of these the earliest were the merchant guilds, first mentioned at the close of the 11th century. They were associations of traders formed for mutual protection and monopoly of trade. The early charters granted to English towns regularly included recognition of the local merchant guilds. In the beginning they did not exclude craftsmen. Although rarely identical with the town government, these guilds exercised numerous governmental and social functions. Disputes between members were settled by the guild; if imprisoned they

were ransomed. Certain municipal administrative functions were entrusted to them. As a mutual benefit society the guild aided its needy members, paid for their funerals, and contributed toward the support of their widows and children. During the 14th century the merchant guilds declined and were eventually superseded by the craft guilds. These were local associations of artisans in a particular industry. The problem of their origin is still a matter of controversy, some authorities believing that they developed out of the merchant guild, others holding that they developed independently. There are sporadic references to such organizations as early as the 11th century. They flourished in Europe from the 13th to the 16th century, continuing with waning power through the 18th.

Protection of Consumer and Craftsman. Not every town possessed craft guilds, but where they existed each craft had its own guild, which regulated the conditions under which that industry was carried on. Under the guild system industry was highly specialized. In a single town, for example, the leather industry might include a dozen separate guilds. The consumer was protected by regulations governing the quality of the work, the material used, and the price; the craftsmen by rules regarding wages, hours of work, etc. In Florence the number of vats into which the dyer must dip his wares was specified; the Parisian linen weaver must produce pieces of a specified length. These rules were enforced by guild officials who periodically inspected the workshops of guild members. At the height of guild power enforcement was thorough, but as markets expanded and the guilds became more exclusive in their membership nonmembers set up workshops, usually in rural districts, and produced goods outside of guild regulation.

Membership in the craft guild was normally attained by passing through the preliminary stages of apprentice and journeyman. The parents or guardian of a child who wished him to learn a trade apprenticed him to some master of that craft, paying a fee for the privilege. (*See* APPRENTICESHIP). In return the master provided board and lodging, and instructed him in the craft. In this way craft guilds served as the technical schools of the Middle Ages. Guild statutes limiting the number of apprentices allowed a single master were for the purposes of insuring proper technical training as well as for the protection of the journeyman wage earner. After a specified term, approximately seven years, though the period varied greatly, the apprentice became a journeyman, working by the day for his master, but no longer living under the master's roof. Admission to full membership in the guild of masters depended on his complying with certain guild regulations and submitting an example of his skill which must meet the approval of the guild officials, the so-called "masterpiece." In practice the guild was far from being the democratic organization it seemed to be. Frequently a group of masters exercised aristocratic control, abusing their privileges and restricting the rights of journeymen and apprentices. Often the journeyman was unable to accumulate sufficient funds to become a master. Occasionally, especially on the Continent, journeymen who were prevented from becoming masters formed associations of their own and endeavored to shake the power of the masters.

Social and Benevolent Functions. Like the merchant guilds, the craft guilds exercised certain social and benevolent functions. Some guilds maintained a common treasury for the support of aged or infirm members and their dependents. There are also instances of pensions for widows, as well as appropriations for the funerals of indigent members. They held regular meetings for the transaction of business, as well as more informal banquets. On occasion the guilds of a town might cooperate in the presentation of a mystery play. (*See* MYSTERY PLAYS.) Each guild was responsible for a particular scene in the pageant.

Certain non-industrial guilds existed whose sole functions were social and religious, somewhat analogous to modern fraternal organizations. They were semi-religious in nature, with a voluntary membership in no way connected with trade or industry. Such a guild might be devoted to the cult of a particular saint, or exist merely for the general spiritual good of its members. They were to be found in small villages as well as the larger towns, and bear witness to the medieval passion for organization. In England they existed from Anglo-Saxon times, and are among the guilds of various sorts which were abolished by the statute of 1547.

As industry became more complicated guild control of industry lessened. The minute regulations tended to disappear, as in England, or were supplanted by equally minute governmental regulations, as in France. By the 18th century the guilds had lost their importance and either disappeared or for the most part retained only their social functions; almost anyone might then be admitted on payment of a fee.

Guilds have been compared to modern trade unions (*see* LABOR ORGANIZATIONS), but opinions differ as to the degree of likeness. It is agreed, however, that guilds were broader in nature, since their members were employers as well as laborers; the guild existed to further the interests of the whole trade, including consumers, rather than merely those of the classes which helped to carry it on. W. I. B.

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GUILD SOCIALISM, an English socialist theory, first advocated in 1911, which accepts the syndicalist criticism of state socialism, i.e., because socialism gives the state absolute ownership and control of the means of production, it gives the people power only as consumers—none as producers. Guild Socialists also accept the state socialist criticism of syndicalism, i.e., that, because it gives absolute ownership and control of each industry to a union of its

workers, the people have power only as producers. Therefore Guild Socialists propose that each industry shall be under the control of a national guild of all its workers, which will direct the technical and production problems, the distribution of income and all matters affecting the industry that do not affect the interests of the community. The guilds will pay rent to the state for the use of the physical means of production, which the state will own.

Politically, a parliament is proposed, elected geographically, representing the people as consumers; and a guild congress, containing delegates from the guilds, representing the people as producers. Each of these bodies will elect representatives to a joint committee. This joint committee, above both parliament and congress, will deal with matters touching the interests of both producers and consumers, such as commodity prices, guild rents and the like.

Guild Socialism, as a separate movement, was abandoned in 1922. It has, however, made an indelible impression on the aims and philosophies of the trade union and political labor movements of Great Britain.

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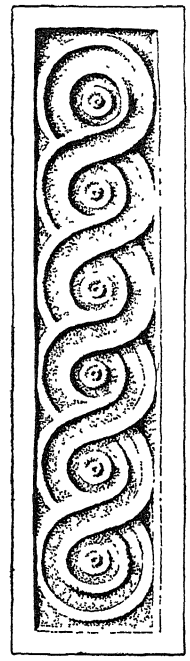
GUILFORD COURT HOUSE, BATTLE OF, Mar. 15, 1781, an engagement of the REVOLUTIONARY WAR, between 4404 Continental troops under Gen. Greene and a British force of 2213 commanded by Lord Cornwallis. Having seriously reduced Cornwallis's fighting strength by his victory at Cowpens (*see* COWPENS, BATTLE OF), Greene attempted to draw Cornwallis into battle by feigning retreat. The maneuver was successful, and after permitting himself to be pursued northward across North Carolina to within 30 miles of the Virginia border, at Guilford Court House, a small village, Greene offered battle. The addition of Morgan's volunteers gave the Continental force the numerical advantage; but the stubborn charge of the British regulars was halted only by the Continental cavalry under Col. William Washington. After five hours' battle the Continental force withdrew, after having suffered heavy casualties and desertions. The British casualties, about 500, were slightly heavier; the British army, nominally victorious, was too weak to renew the attack.

GUILLAUME, CHARLES EDOUARD (1861-), French physicist, was born at Fleurier, Switzerland, Feb. 15, 1861. He developed an alloy of nickel steel (invar) with an exceedingly small expansion under heat. He improved technical methods of nickel-steel manufacture and applied invar for precision geodetic surveying. In 1920 he received the Nobel Prize in physics. He has been director of the International Bureau of Weights and Measures since 1915. He wrote *Practical Treatise of Precision Thermometry,* 1889, *Researches upon Nickel-Steel,* 1899, and, with I. R. Benoit, *Rapid Measurement of Geodetic Bases,* 1908.

GUILLAUME DE LORRIS (d. c. 1240), medieval French poet, was born at Lorris in what is now the Department of Loiret. He is the author of the first quarter of the ROMAN DE LA ROSE, which, after his untimely death, was completed by JEAN DE MEUN. Guillaume showed himself to be more poetically gifted than his co-author, and is generally ranked among the great poets of medieval France. Nothing is known of his life. It is thought that Guillaume died about 1240.

GUILLEMOT, a genus (*Cepphus*) of web-footed maritime birds of the auk family (*Alcidae*) found in northern regions. They are robust birds the size of a small duck, living chiefly on the open sea, where they feed upon various aquatic animals, but coming ashore in rocky regions to breed. Although awkward on their feet they fly strongly and rapidly and dive well. The best-known species, the black guillemot (*C. grylle*), is about a foot long with summer plumage mostly black marked with a half white wing patch, and winter plumage whitish marbled with black. It occurs in the north Atlantic and in North America winters as far southward as New Jersey, nesting in rock crevices and laying two or three large, spotted eggs. The tough flesh and also the eggs are used for food in the North. A closely allied species, the pigeon guillemot (*C. columba*), differing chiefly in wing markings, occurs on the Pacific coast from California northward.

GUILLOCHE, a classic ornament for a molding, band or panel consisting of a conventionalized representation of a narrow ribbon or ribbons winding around circular buttons placed in a line and close to each other, or else around a series of small or large disks, or disks, squares and diamonds. The form probably developed from basketry, as its simple forms much resemble the edge of a basket seen from above. It was used in early Greek pottery, and appears in architecture in the Periclean period, as in the base molding from the Erechtheum, c. 415 B.C. During the Byzantine and Romanesque periods, the guilloche was the basis of many mosaic patterns used in floors and for church furniture. The band was formed of geometric *Opus Alexandrinum* mosaic, or mosaic formed of units of standard size and shape, and the disks of rich colored marble often obtained by slicing antique columns. The whole was usually let into a white marble ground.



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IONIC GUILLOCHE
From the Erechtheum, Athens

GUILLOTINING. *See* CAPITAL PUNISHMENT.

GUILMANT, FÉLIX ALEXANDRE (1837-1911), French organist, was born at Boulogne, Mar. 12, 1837. He studied with Lemmens, Carulli, and with his father, Jean Baptiste Guilmant (1793-1890), whom he assisted at St. Nicholas Church, Boulogne. He was appointed organist at Ste. Trinité, Paris, in

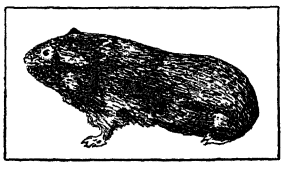
1871, remaining in that post for 30 years. In 1894 he aided in founding the Schola Cantorum in Paris and in 1896 joined the faculty of the Paris Conservatoire. He toured extensively in recital, visiting the United States in 1893 and 1897. Both as a performer and as a pedagogue he exercised a profound influence on contemporary organ technique. His researches into the history of organ playing, *Archives des Maîtres de l'orgue* and *École classique d'orgue,* are exemplary standards of musical editorship, while his compositions, including eight organ sonatas, have found a permanent place in the modern repertory. The Guilmant Organ School was founded by his pupil, William C. Carl, in New York City in 1899. Guilmant died at Paris, March 12, 1911.

GUINEA, a gold coin equivalent to 21 SHILLINGS used in Great Britain between 1664 and 1817. It was first made from gold that was shipped from the Guinea coast of west Africa and thus derived its name.

GUINEA FOWL, a group (*Numidinæ*) of game birds native to Africa and Madagascar, closely allied to the pheasants. Of the some 23 species the best known is the common guinea fowl (*Numida meleagris*) of western Africa. This bird is about the size of a domestic hen, with dark slaty plumage covered with roundish white dots and a bony yellowish helmet on its bare red head. In habit it is gregarious, sometimes going in flocks of 100 or more; it feeds upon grasses, seeds, berries, roots and insects. It runs swiftly but its short wings and heavy body prevent extensive flight. The guinea fowl nests in a slight depression in the ground, laying 12 to 20 hard-shelled, rusty-spotted, yellowish eggs.

Since ancient times this species has been highly prized for its flesh and eggs. It was widely domesticated by the Greeks and Romans but disappeared from Europe during the Middle Ages. Since its reintroduction by the Portuguese in the 16th century it has spread to many countries and has reverted to the wild state in some of the West Indies. Notwithstanding its excellent flavor, the guinea fowl is not widely popular because of its noisy discordant cries, quarrelsome disposition and the difficulty of rearing its young except in very dry climates. A. B. J.

GUINEA PIG, a name popularly applied to a domesticated species of cavy (*Cavia cutleri*), native to Peru. It is a small tailless rodent, about 6 in. long and usually black, white or tawny in color. In structure it is somewhat intermediate between the rabbits and the rats. The domesticated guinea pig is exceedingly prolific, sometimes beginning to breed at the age of two months, and producing as many as 12 at a litter five or six times in a year, so that a single pair may become the parent stock of 1,000 descendants annually. Though at first kept in Europe and the United States mainly as a safe pet for children, the guinea pig is now extensively used in biological laboratories for experimental purposes. Mummies found in the tombs at Ancon, Peru, indicate very ancient domestication of the guinea pig in the Andean region of South America, where it is still reared for human food. *See also* CAVY.



GUINEA PIG

GUINEA WORM, the common name for a parasite (*Dracunculus* or *Filaria mendinensis*) which causes the guinea-worm disease (*Dracontiasis*) in man. This parasite belongs to the group of thread worms (*Nematoda*), and is found in the tropics and subtropics of both hemispheres.

Part of the larval life of the guinea worm is thought to be passed within the body of a water flea (*Cyclops*). By being swallowed in drinking water the parasite is introduced into the human body by the water flea, but it is not certain that it cannot enter directly through the skin. Usually the worms establish themselves under the skin of the legs and feet. Their presence is manifested by local inflammation, and, as the disease progresses, by thinness of flesh and weakness. An adult worm is sometimes 3 ft. long, and ⅛ in. in diameter. The creature should be removed with great care, to avoid having part of it break off and remain in the patient's body.

GUINEVERE, in the ARTHURIAN LEGENDS, the wife of Arthur who brings disaster to the Round Table by her unfaithfulness with Launcelot. Her story is beautifully told in William Morris's *Defence of Guinevere,* as well as in Tennyson's IDYLLS OF THE KING.

GUINEY, LOUISE IMOGEN (1861-1920), American poet, was born in Roxbury, Mass., Jan. 7, 1861. Her best known works are perhaps *Songs at the Start, A Roadside Harp, Patrins,* essays, *The Martyr's Idyl,* and *Happy Ending,* her last book of poetry published in 1910. In 1911 *The Poetry of Louise Imogen Guiney,* selections by Edward J. O'Brien, was published. The story of her life is told by E. M. Tenison, *Louise Imogen Guiney,* 1923. She died Nov. 2, 1920 in England, where she had been studying and editing minor 17th century poets.

GUINICELLI, GUIDO (c. 1240-76), Italian poet, was born at Bologna about 1240. A lawyer and jurist at Bologna, he was expelled in 1274 from his native city because of his Ghibelline connections. He founded and headed the Bologna school of mystical love poetry comprising such contemporaries as Cino da Pistoja, GUIDO CAVALCANTI and DANTE himself. His sonnets and *canzoni* dwell on the theme of love and infuse a neo-platonic strain into the conventional troubadour love songs of Provence. Guinicelli, whom Dante called "the father of Italian poetry," died in exile in 1276.

GUITAR, a stringed musical instrument belonging to the lute family, commonly confined to accompaniments but capable of brilliant solo work in the hands of a skilled performer. Apparently it is of Oriental origin. The number of strings varies, but six are usual, three of them made of gut and three of silk overspun with wire. Music for it is written in the treble clef, and one octave higher than the tones

played. Its written *accordatura,* or tones to which the strings are tuned, is e—a—d′—g′—b′—e″. *See* Octave for an explanation of this terminology.

GUITERAS, JUAN (1852-1925), Cuban physician, was born at Matanzas, Jan. 4, 1852. He graduated in medicine at the University of Pennsylvania in 1872, and from 1879 to 1889 he was connected with the U.S. Marine Hospital Service. Following this, he became professor of pathology at the University of Pennsylvania and returned to Cuba in 1898 on the staff of General Shafter. Here he was invaluable in the fight upon yellow fever. In 1900 he became professor of pathology and tropical diseases at Havana and in 1921 president of the Cuban Board of Health. He died at Matanzas, Oct. 28, 1925.

GUITERMAN, ARTHUR (1871-), American author, was born in Vienna, Austria, Nov. 20, 1871, and graduated in 1891 at the College of the City of New York. Between 1891-1906 he did editorial work for various magazines, including the *Woman's Home Companion* and *Literary Digest,* and in 1912-15 lectured on magazine and newspaper verse at the New York University School of Journalism. He published several volumes of verse, including *The Laughing Muse, The Mirthful Lyre, Ballads of Old New York* and *Song and Laughter.*

GUITRY, SACHA (1885-), French actor and playwright, was born at Petrograd, Russia, Feb. 21, 1885. His father, Lucien Guitry, was a noted actor. At 20 Sacha Guitry wrote a successful play, *Nero,* and since has been the author of more than 60 plays, mostly comedies, in which he and his wife, Yvonne Printemps Guitry, usually acted. Among these were *Deburau,* 1918, *Bérenger,* 1920, *Sujet de roman,* 1923, *On ne joue pas pour s'amuser,* 1925, and *Pasteur,* 1919. The Guitrys visited New York with *Mozart,* 1929.

GULDEN, gold monetary unit of the Netherlands and the Dutch East Indies, equal to about 40.2 cents United States money; it is also called guilder and Florin, the latter being the name usually applied to it. The florin was a silver coin until the Gold Standard was adopted by the Netherlands in 1875.

GULFPORT, a city of southern Mississippi, the county seat of Harrison Co., situated as a port of entry on the Gulf of Mexico, about 68 mi. northeast of New Orleans. It has an excellent harbor, protected by two islands and a stone breakwater. Several steamship lines, two railroads and buses provide transportation. There is an airport. Gulfport is a popular year-round resort. Its industries include railroad shops, shipbuilding, lumber concerns, canning factories and sawmills. In 1929 the retail trade amounted to $6,528,107. A United States Veterans' Bureau Hospital is located here. Gulfport was incorporated as a city in 1897 and adopted a commission form of government in 1911. Pop. 1920, 8,157; 1930, 12,547.

GULFSTREAM, a current of warm water originating in and named after the Gulf of Mexico. It flows northeastward a little distance out from the Atlantic coast of North America, into the northern part of the Atlantic Ocean. The Gulfstream has its origin in the northeast trade winds of the north-equatorial Atlantic, which blow the warm, tropical water into the Gulf of Mexico, whence it can escape only through the narrow strait of Florida. Here the stream is about 50 miles wide and nearly 400 fathoms deep; its speed is estimated at 4 knots and its temperature more than 80° F. Soon after leaving the strait it expands, becomes shallower, and slows down, until off Charleston it is about 150 miles wide and has a speed of a little more than 2 knots. Near Sandy Hook it is 300 miles wide, and its water level is more than three feet lower than in the Gulf of Mexico; the temperature drops more than 10° F. Deflected by the Great Banks of Newfoundland, it then flows eastward and nearly loses its identity in the Atlantic where its speed drops to below five miles per day, though it can be traced beyond Scotland and Norway to Spitzbergen. Another branch, which turns south, completes the circuit, and joins the main westward flow of equatorial water again near the Azores, leaving a central, stagnant, currentless area of water known as the Sargasso Sea.

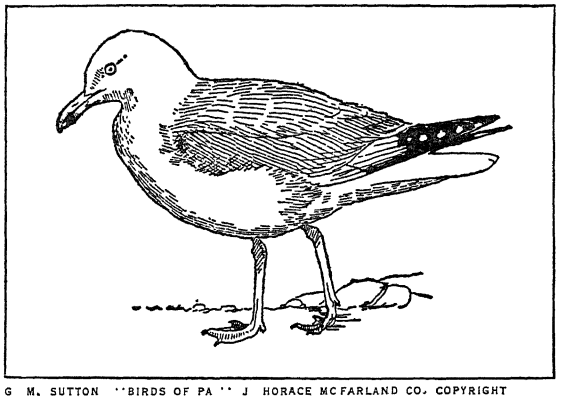
The part of the Gulfstream that flows into the Arctic finds its return in the form of the Labrador current, a very cold stream that flows southward from Greenland and Labrador, separates the Gulfstream from the east coast of the United States by forming the "cold wall," and, ultimately sinking below the Gulfstream, reaches the tropics. Where the two currents run side by side, but in opposite directions, they can be easily distinguished. The Gulfstream is warm, tranquil and blue, while the Labrador current is cold, muddy and greenish.

It has long been held that the warm waters of the Gulfstream exerted a powerful influence in moderating the climate of northwestern Europe, but it is now believed that the part played by the Gulfstream direct is comparatively small, and that the mildness of the climate is due chiefly to the warm, moisture laden, westerly winds that prevail over the north temperate zone. The dense fogs that are so typical of the region of the Grand Banks of Newfoundland appear to be a direct consequence of the Gulfstream, since the air above it is warm and saturated with moisture which condenses upon meeting the cold waters of the Labrador current. W. J. L.

GULFWEED, a species of brown-seaweed (*Sargassum bacciferum*) found floating in the Gulf of Mexico, called also Sargasso weed. It occurs in great abundance, sometimes forming large tangled masses, portions of which are carried northeastward by the Gulf Stream, small bits occasionally drifting as far as the British Isles. Gulfweed is a branching plant with narrow, toothed leaves which bear small fruiting vescicles in the axils and also numerous berry-like, short-stalked air-vessels or floats. Various polyzoans and other low forms of life form colonies on the surface of the leaves, and numerous marine animals, as the sargassum-crab, the sargassum-shell, and the sargassum-pipefish, float about with it. *See* Sargasso Sea.

GULICK, LUTHER HALSEY (1865-1918), American educator and author, was born at Honolulu, Dec. 4, 1865. He graduated in 1889 at the New York University School of Medicine and until 1900 was superintendent of physical training at the Y.M.C.A., Springfield, Mass. From 1903-08 he had charge of physical training for the New York City schools and from 1908-13 was director of child hygiene for the Russell Sage Foundation. He published the Gulick hygiene series and a manual of physical measurements. In 1913 he became national president of the Camp Fire girls. Gulick died at South Casco, Me., Aug. 13, 1918.

GULL, an aquatic bird of the family *Laridæ;* separated from the terns, skimmers and skuas. These long-winged swimmers have strong, horny hooked bills, webbed feet, and are scattered throughout the world in a great number of wide-ranging species. They are migratory and breed in companies, making very simple nests on the ground, near water, most frequently on remote islands and beaches, or on the ledges of coast-cliffs. While essentially marine, and feeding on fish and lesser oceanic creatures, in summer all are inclined to pick up insects or berries on land, and several species frequent inland lakes and marshes, notably in northwestern Canada. As a rule, the plumage is white with a bluish gray mantle and specific black markings. The most familiar species in northern Europe and America is the herring or harbor



G. M. SUTTON "BIRDS OF PA." J. HORACE MCFARLAND CO. COPYRIGHT

HERRING GULL
Breeding plumage

gull, white with bluish back and wings tipped with black; the adult sexes are alike; but the young of the first year are mottled brown. Other North American species are the northern glaucous, ivory and Iceland gulls, the large black-backed gull of the northern Atlantic seaboard, the western California, the glaucous-winged, the maritime kittiwakes and the black-headed, laughing, Franklin's and Bonaparte's gulls, the last not much larger than a pigeon. E.I.

GULLIVER'S TRAVELS, a biting satire in the form of a romance, by JONATHAN SWIFT; published 1726. Dr. Lemuel Gulliver, a retired ship surgeon, makes four extraordinary voyages. The first of these takes him to the land of the Lilliputians, a race of dwarfs who have as many controversies among themselves—political, military and social—as mankind itself. One next finds Gulliver among the Brobdingnags, fantastic giants some 60 feet in height. The third voyage lands the hero on the floating island of cement, Laputa, where dwell the Philosophers in their bewilderment. Lastly he comes among the Houyhnhnms, a race of horses whose intelligence easily exceeds that of their human brothers. A favorite among children because of its unusual situations, *Gulliver* stands to the adult reader as one of the bitterest satires ever written.

GULLSTRAND, ALLVAR (1862-), Swedish physician, was born at Landskrona, June 5, 1862. In 1894 he became professor of physiological and physical optics at the University of Upsala. In 1911 he received the Nobel prize in medicine for his investigations of eye defects, particularly astigmatism.

GUM ARABIC. *See* ACACIA.

GUMBO, one of the various names for OKRA, a soft-stemmed annual grown in the southern United States for its gummy seed-pods used for thickening soups.

GUM, CHEWING. *See* CHEWING GUM; CHICLE.

GUMPLANT, the common name for a genus (*Grindelia*) of coarse perennials of the composite family. There are about 35 species, all native to western America, found from Saskatchewan to Patagonia and most numerous in Mexico. They are usually slightly shrubby plants, rather low in stature, with branching stems bearing oblong toothed leaves, and large, solitary, yellow flower-heads. When young, most species have all their parts more or less covered with a sticky varnish, especially the cups of the budding flower-heads, which are often completely filled with a gummy exudation. Among the best known American species are the broad-leaved gumplant (*G. squarrosa*) of the Great Plains and the western gumplant (*G. robusta*) of the Pacific coast.



FROM JEPSON, MAN. FL. PLANTS CALIF. COPYRIGHT

FIELD GUMPLANT
Grindelia camporum

GUMS, a class of non-crystalline vegetable excretions which belong to that organic group of compounds known as CARBOHYDRATES. They vary in type from hard resin-like to soft sticky masses. Their chief characteristic lies in forming mucilaginous, colloidal emulsions (*see* COLLOIDS) in water although some types merely swell up to form jellies. Gums are insoluble in ALCOHOL and may be precipitated from water solution by its addition. Their principal uses

are in water solution as adhesives; as mucilaginous clarifiers of organic liquids; as agents to homogenize or suspend colors in inks, dyeing, etc.; as sizing agents for textiles and papers; and in confectionery and pharmacy. The most commonly used is gum arabic obtained largely from African ACACIA trees. This is generally supplied in the form of colorless or light yellow rounded nodules called "tears." Gum tragacanth from a species of *Astralagus* grown in Greece and Asia Minor is also widely known. It flows freely from the stems when they are wounded and is softer than the acacia or cherry gums. It is much less soluble in water than is gum arabic. Gums differ in kind from resins (*see* RESINS, NATURAL). The name "Gums" of the varnish industry is a misnomer; they should be called resins. Certain plants exude mixtures of gums and resins, called gum-resins, such as asafoetida, gamboge, frankincense and myrrh. R. J. M.

GUNBOATS, vessels of light draft carrying one or more guns, used along coasts and in rivers. In the U.S. Navy there are a small number of gunboats in commission. Most of these are river gunboats and are used on the coasts and in the rivers of the Far East.

GUN COTTON, a nitrocellulose containing not less than 13.2% of nitrogen, not more than 25% soluble in a 2:1 by volume mixture of ether and alcohol. It is made by immersing purified cotton in a strong mixture of nitric and sulphuric acids, driving out the excess of acid by centrifuging, washing, boiling in water and afterwards in a very dilute sodium carbonate solution to remove all traces of acid and unstable compounds. Gun cotton has the same appearance as the cotton or other CELLULOSE material from which it is made. It is easily ignited, and burns in the open with a quick flash. It explodes when sufficiently jarred, or by the detonation of an adjacent explosive. It is relatively safe when wet with water, although even then it can be detonated by other explosives.

Gun cotton is no longer used as an explosive charge. It has been replaced by other EXPLOSIVES, such as TRINITROTOLUENE or its admixture with ammonium nitrate. When colloided and processed, gun cotton is an ingredient of certain smokeless powders. Gun cotton should not be confused with the soluble varieties of NITROCELLULOSE, ordinarily known as PYROXYLIN, used in LACQUERS, CELLULOID, artificial leather, and other similar substances. E. M. Sy.

GUN METAL, an alloy of copper and tin, at one time used in making guns, but later replaced for this purpose by steel. It is now used for various machine parts, common proportions being 90% copper and 10% tin.

GUN MOUNTS. For land guns the mounts consist essentially of a bed for the piece, with means for giving direction and elevation to it and for controlling recoil. The carriage proper, or chassis, may be on wheels or on a pedestal or other fixed base. Upon this rests some form of top-carriage, supporting the gun; the two parts are connected by a mechanical system for taking up the shock of recoil and a spring or compressed air device for returning the piece to firing position. The gun with its supporting parts is capable of motion in traverse and in elevation without disturbance of the carriage proper. Sights and other laying devices are secured to non-recoiling members of the system.

For warships, guns too small for turrets are fitted on pedestal mounts. The stand, bolted to the deck, carries a roller-path or ball-race on which the top-carriage is revolved in azimuth by the training gear. Trunnions in the carriage support the slide, which is laid to any elevation angle by the pointing gear. In recoiling in the slide, the gun is checked by hydraulic recoil mechanisms and returned by counter-recoil mechanisms. Seats or platforms, rotating with the mount, are usually provided for the pointers and trainers. Twin mounts carry two guns. *See also* GUN; ORDNANCE.

GUNNER, usually a corporal, at the head of a squad of cannoneers who serve one gun. The gunner personally lays the gun for range and direction (*see* RANGING), and is charged with setting the sights, quadrants and other instruments employed for this purpose. He is responsible for the general upkeep of the gun.

GUNNERY, the art of using guns to produce a desired effect upon a designated target. Efficiency is obtained by full knowledge of the possibilities and limitations of the GUNS to be used, by complete information as to the character and position of the target to be attacked, by proper evaluations of the condition of the atmosphere between the gun and the target, and by careful and systematic training of the operating personnel at the guns to insure accurate angular settings of the gun carriage and the projectile fuse.

The information regarding the guns is obtained at ordnance proving grounds from repeated firings of the guns on their gun carriages at all ranges. The results of these firings are carefully corrected and published as firing tables. These tables indicate the expected ranges and deviations therefrom under varying conditions of atmosphere and ammunition for given settings of the gun carriages and fuses. From such data the probability of hitting the target when other conditions are normal is determinable.

The character and position of the target is determined by reconnaissance and by special range finding and observation instruments. The atmospheric conditions are obtained by special meteorological instruments and by observation. The firing tables indicate the corrections to be made for variations from the normal conditions under which the tables were constructed. From repeated practice firings in the field, the errors of the operating personnel are evaluated. The gunnery officer using this data should be able to give proper directions for the conduct of fire and should be able to determine the amount of firing required to damage the target sufficiently for the purposes of his attack. (*See also* FIRE CONTROL; RANGING.) C. G. M.

The principles of naval gunnery are similar. At the NAVAL PROVING GROUND guns are fired at different elevations and the fall of shot observed so that, with this data and ballistic computations, range tables can be prepared for graduating sight scales and fire control instruments. On shipboard the preliminary data of ranges, estimated course and enemy speed are supplied to the rangekeeper, together with corrections for meteorological conditions, erosion and powder temperature. From a position aloft and after all guns are following the same data as the director, the director operator fires a SALVO electrically. The spotter, generally in the same station and using a high-power spotting glass, notes the fall of shot and gives his estimated correction or spot to apply to the data for the next salvo. At extreme range, particularly with the target's water-line below the horizon, it generally is impossible for him at first to establish this correction directly or to tell much more than whether the salvo is short, straddling, or over; and it may be necessary to correct the deflection before even this much can be known. But if corrections in the proper direction are made, generally of fixed amounts, it becomes evident, after a few salvos, when the splashes have crossed the target in range or have been brought on. Rapid fire is then commenced; for prior to that, the guns are loaded and ready to fire before the splashes appear but delay till spots are applied.

In rapid fire at long ranges, several salvos are often in the air simultaneously. Even when on the target, changes of course by the enemy (the firing ship's changes are automatically taken care of) may throw the shots off and necessitate frequent spotting. Firing a number of salvos as rapidly as possible at different ranges to establish the correct range is called laddering and is particularly useful with secondary batteries which have less elaborate fire control systems. Aircraft at considerable altitudes can spot with superior accuracy and transmit spots by radio. Using aircraft observations, firing can be conducted beyond the limits of visibility. Antiaircraft gunnery is more complex than gunnery at surface targets, as in it a third dimension must be considered in rangekeeping and spotting. *See also* ARTILLERY. G. L. S.

GUNNISON RIVER, a tributary of the Colorado River, formed by the East and Taylor rivers in Gunnison Co., Colorado. These headstreams rise in the snow-covered peaks of the Continental Divide. The main river flows west and southwest and after a course of about 200 mi. joins the Colorado at Grand Junction in Mesa Co. Midway along its upper course it flows for 56 mi. through winding granite walls called the Black Canyon. The river has a fall of about 6,500 ft. and affords many power sites, few of which have been utilized. Its greatest use is for irrigation.

GUNPOWDER, or black powder, an explosive, granular mixture of 75% potassium nitrate, 15% wood charcoal, and 10% sulphur, though the exact proportions may vary. The grains are given a slight coating of graphite to resist moisture and to make the powder flow more easily. On burning, it generates large quantities of smoke. While its rate of burning can be regulated somewhat by varying the size of the grain, black powder generates high pressures at the breech of a gun, and low pressures along the rest of the barrel, thus limiting projectile velocities. It has been replaced by SMOKELESS POWDER. *See also* EXPLOSIVES.

E. M. SY.

BIBLIOGRAPHY.—A. Marshall, *Explosives.*

GUNPOWDER PLOT, THE, was a conspiracy of Roman Catholics to blow up Parliament and James I of England, on Nov. 5, 1605. The plot was organized by Robert Gatsby, Robert Winter and John Wright in answer to the renewed enforcement of laws forbidding Catholic worship in England. They won over some prominent Catholics and in Apr. 1605 induced GUY FAWKES, a soldier of fortune, to come over from Flanders and carry out the plot. A cellar under the House of Lords was rented, and in it was placed the gunpowder. But the plot was betrayed by an anonymous letter sent to Lord Monteagle, a Catholic, and the powder was discovered on Nov. 4. Fawkes was arrested and under torture betrayed the plotters. Some of the conspirators in Warwickshire, assured by Gatsby that the plot had already succeeded, rose in armed insurrection. The country failed to join, and they were soon captured or killed. Eight of the conspirators, including Fawkes, were executed.

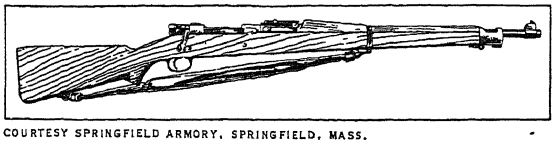
GUNS, a term applied in general to any firearms; in a military sense a cannon with a long barrel, firing with high velocities and used at low angles of elevation. One with a short barrel, firing at low velocities and used at high angles of elevation, is termed a mortar; one with a barrel of intermediate length between the gun and mortar, firing at intermediate velocities and using intermediate angles of elevation, is termed a howitzer. Referring to the target, it is sometimes said that a gun attacks the vertical surfaces, the howitzer the sloping surfaces, and the mortar the horizontal surfaces.

A gun is made to withstand high interior pressures. Modern guns are made of high quality steel tubes, assembled with carefully calculated shrinkages, one upon the other, in such a manner as to place the steel nearest the bore in compression when the piece is at rest. The same interior effect is also obtained by winding the interior tubes with high quality steel wire at a carefully calculated tension. Since the World War several nations have developed a process known as cold working, or autofrettage, in which single steel tubes are subjected to such interior hydraulic pressures that the inner layers of metal are stressed beyond the elastic limit, taking a permanent set. When the pressure is released the outer layers, which do not take a permanent set, contract upon the inner layers, placing them in compression. When the gun is fired, the inner layers are not stressed until a large part of the pressure is transmitted to the greater volume of exterior metal. *See also* GUN MOUNTS; ORDNANCE.

Guns and rifles, in sports, are weapons developed especially to shoot game animals and birds and

at targets. The hand gun of the early 15th century was a simple metal tube fixed to a straight stock of wood, having a touch hole through which the powder was ignited with a slow match. It was not until the invention of the wheel-lock, almost a century later, that firearms were adapted to sporting purposes. The less cumbersome flintlock of the 17th century was the first real sporting piece, since it was the first gun which could be moved quickly enough and shot fast enough to be efficient. Among the finest flintlocks ever made were some of the Kentucky long rifles of the Revolution. Up to a hundred yards they were about as accurate as a modern rifle.

The breech loading mechanism was invented as early as 1540, but a really satisfactory cartridge was not developed until the 19th century. The modern rifle is a beautiful piece of mechanism made in many calibers from the .22 for target and small game shooting to the .470 double barrel elephant gun. Repeating rifles to-day carry from 5 to 20 shells, depending on the caliber. There are automatic rifles which need only a touch on the trigger to fire them until empty. Shotguns are made in .405, 20, 16, 12 and 10 gauge, the 12 gauge being the standard for land birds and the 10 gauge for waterfowl. Shotguns are made in several barrel lengths, in regular or choke bore, single or double barrel, repeating and automatic.



COURTESY SPRINGFIELD ARMORY, SPRINGFIELD, MASS.

UNITED STATES SPRINGFIELD RIFLE, .30 CALIBER

GUNSAULUS, FRANK WAKELEY (1856-1921), American clergyman, was born in Chesterville, O., Jan. 1, 1856. He was graduated in 1875 at Ohio Wesleyan and was ordained a Methodist minister but later became a Congregationalist. He held pastorates at Columbus, O., Baltimore and Chicago and in 1893 became president of the Armour Institute of Technology. He was a popular lecturer on Savonarola, John Hampden and other subjects. Gunsaulus died at Chicago, Mar. 17, 1921.

GUN SIGHTS. In firing, the gun axis must be pointed at a predetermined elevation angle above the target (*see* RANGING; FIRE CONTROL) and at a predetermined deflection angle to one side. The gun sight, carried on the slide, is a mechanism which by means of graduated scales enables one to set the gun-sight telescope at the proper elevation and deflection angles from the bore. To aim, the trainer and pointer have then only to move the gun so that the crosslines of their telescopes are on the target. *See also* ARTILLERY.

GUNSTON HALL, the former mansion of GEORGE MASON (1725-92), in Fairfax Co., Va., situated on a bluff overlooking the Potomac about 4 mi. from MOUNT VERNON. The house, built by Mason in 1758 on an estate originally of 7,000 acres, has thick brick walls, tall unsupported chimneys, and is 80 ft. long and 40 ft. deep. Washington, Jefferson, Lafayette and other great Colonial figures were frequent visitors at Gunston Hall, and it may have been there that Mason and Jefferson first drew up the Bill of Rights.

GURNARD, or sea robin, a marine fish, found on the coasts of tropical and temperate seas. The gurnard family (*Triglidae*), which contains numerous species, includes the sea robins of the United States (*Prionotus*) and is related to the flying gurnards (*Cephalacanthidae*) with elongated pectoral fins, enabling them to travel a short distance in the air. Many of these fishes are marked with a variety of beautiful colors. They are good food fish although they are little marketed in America and are usually caught with a trawl, since they prefer to live near the bottom in deep waters. Gurnards are spiny-rayed, with rounded tapering bodies about 18 in. long, and bony-plated head covering. They are distinguished by their large pectoral fins from which the first three fin-rays are separated, aiding them in discovering food and in locomotion. When taken from the water, gurnards often make a grunting noise.

GUSTAV V. *See* GUSTAVUS.

GUSTAVUS I VASA (1496-1560), King of Sweden, was born at Lindholmen, Upland, May 12, 1496. He was of noble birth, being descended from the house of Vasa on his father's side and from the house of Sture on his mother's side. He was educated chiefly at the court of his kinsman, Sten Sture the younger, who was regent in Sweden, and he served under Sten against the Danes. During the negotiations which eventually led to Sweden's acceptance of the Danish king, Christian II, as King of Sweden, Gustavus was sent as a hostage to Christian II and was carried off to Denmark in violation of the agreement. He escaped and returned to Sweden. After the Stockholm Massacre in 1519, in which his father was killed, Gustavus led a revolt of the peasants of Dalecarlia. In 1523 he captured Stockholm. The diet elected him King on June 6 of that year, thus ending Sweden's subjection to Denmark. As King, he favored the Reformation and opposed the Roman Catholic clergy. In 1527 he caused the lands of the bishops to be placed at his disposal and permitted the preaching of the new doctrine. Gustavus died at Stockholm, Sept. 29, 1560.

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GUSTAVUS II ADOLPHUS (1594-1632), King of Sweden, was born at Stockholm, Dec. 19, 1594. He was the son of CHARLES IX and Christina of Holstein, and grandson of GUSTAVUS I VASA. When he succeeded to the throne in 1611, Sweden was at war with Denmark, Poland and Russia. The war with Denmark was ended by a treaty signed at Knäröd, in Holland, 1613, by the terms of which Gustavus relinquished his claim to the Norwegian part of Finmarken. After an armistice had been concluded with Poland, Gustavus carried the war with Russia to a

successful conclusion. The peace of Stolbowa, 1617, shut Russia completely off from the Baltic, by forcing her to cede Karelia, Kexhulm and Ingerinanland to Sweden. The armistice with Poland ended in 1621. King Sigismund was unwilling to conclude peace, and Gustavus invaded Poland and West Prussia. Another armistice of six years was concluded in 1629 on terms favorable to Sweden, and Gustavus was then free to join the side of the Protestants in the THIRTY YEARS WAR. He left the conduct of his realm in the hands of his chancellor, AXEL OXENSTJERNA, and landed in Pomerania with 15,000 men on July 4, 1630. He defeated JOHANN TILLY at Breitenfeld, near Leipzig, Sept. 17, 1631, and again at the River Lech in Bavaria, Apr. 15, 1632, where Tilly was mortally wounded. In the autumn of the same year he defeated Wallenstein at Lützen, Prussian Saxony, but was killed in the battle, Nov. 16, 1632.

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GUSTAVUS III (1746-92), King of Sweden, was born at Stockholm, Jan. 24, 1746. He was the son of Adolphus Frederick, whom he succeeded in 1771. At the beginning of his reign most of the power was in the hands of the nobles, but by a coup d'état in 1772 he succeeded in making the monarchy almost absolute. Because of this he was at strife with the nobles throughout his entire reign. He carried on a war with Russia, 1788-90, but without any decisive result. When the FRENCH REVOLUTION broke out he attempted to form a league of the kings of Europe to aid Louis XVI, and he proposed to lead an army and invade France. The Swedish Rigsdag, or Parliament, however, refused to appropriate money for such an expedition. Gustavus III was the founder of the Swedish Academy and other learned societies. His continued opposition to the nobles caused them to form a conspiracy against him, and on Mar. 16, 1792, he was shot during a masked ball in the Royal Theatre in Stockholm. He died from his wound, at Stockholm, Mar. 29, 1792.

BIBLIOGRAPHY.—C. J. H. Hallendörff and A. Schück, *History of Sweden,* 1929.

GUSTAVUS IV ADOLPHUS (1778-1837), King of Sweden, was born in Stockholm, Nov. 1, 1778. He was only fourteen years old at the death of his father, Gustavus III., in 1792. His uncle, Duke Charles, ruled as regent until Gustavus IV took over the reins of government in 1796. Gustavus soon involved his country in the Napoleonic wars by joining the coalition which England, Austria and Russia had formed against Napoleon. He led a Swedish army into Germany, but he lacked the military skill and accomplished nothing. When Russia made peace with Napoleon in 1807, Gustavus refused to accede to Russia's demand that Swedish ports should be closed to English merchant ships. War with Russia on the East and with Denmark and Norway on the West ensued and Finland was lost to Russia. Discontent with the king and his policy led to a conspiracy among a number of Swedish officers against him. Gustavus was seized, compelled to abdicate and leave the country. He spent the remainder of his life abroad and died at St. Gall, Switzerland, Feb. 7, 1837.

GUSTAVUS V (1858-), King of Sweden, was born at Drottningholm Palace near Stockholm, June 16, 1858, and christened Oscar Gustaf Adolf. He was married, Sept. 20, 1881, to Victoria, daughter of Grand Duke Friedrich of Baden. On the death of his father, OSCAR II, Dec. 8, 1907, he became king, taking the name of Gustavus V. When the WORLD WAR broke out he took the initiative in the agreement to maintain the neutrality of the three Scandinavian kingdoms.

GUSTAVUS ADOLPHUS COLLEGE, a coeducational institution at St. Peter, Minn., founded at Red Wing, Minn., in 1862. In 1876, under the name of St. Ansgar's Academy, it was moved to its present location. The name, Gustavus Adolphus College, was assumed in 1874. It is privately controlled and is affiliated with the Swedish Lutheran Church. The productive funds in 1931 were $515,990. The library contained 19,650 volumes. In 1930 there were 530 students, and a faculty of 35, headed by Pres. O. J. Johnson.

GUTENBERG, JOHANN, an early German printer, of whose early life few details are known. How the idea of printing occurred to him, how he built his type and what sort of press he used are all equally unknown. He moved from his home at Maintz to Strassburg in 1434 and four years later entered into a partnership with three other men apparently with the object of printing, but his earliest known work, the German *Sibyllenbuch,* of which one page is known, dates from 1445. In 1448 he returned to Maintz and receiving financial assistance from JOHANN FUST printed Donatus' *Grammer* and, it seems, an astronomical calendar for 1448. At the time of Gutenberg's rupture with Fust in 1455 appeared the famous *42 line Bible,* called the *Gutenberg* or *Mazarin Bible.* Even this is not always ascribed to Gutenberg and it may have been taken over wholly or partially completed along with Gutenberg's type and press which were awarded to Fust in satisfaction of a law suit at the end of 1455. Two years later Gutenberg received further financial assistance, or at least new type and presses, from Konrad Humery, but what he printed during the succeeding ten years is absolutely unknown. The place and date of his death are alike uncertain.

GUTHRIE, a city in central Oklahoma, the county seat of Logan Co., situated on the Cimarron River, 32 mi. north of Oklahoma City. Bus lines and two railroads afford transportation. An emergency landing field is available. Cotton and grain are the chief crops of the vicinity; fruit and poultry are specialties. Oil and gas fields are found in this region. Guthrie is an industrial center, manufacturing cotton products, twines and ducking. The city was the original capital of Oklahoma. The largest Scottish Rite Temple in the world is located here. Guthrie

was founded in 1889 and incorporated in 1890. Pop. 1920, 11,757; 1930, 9,582.

GUTIERREZ NAJERA, MANUEL (1859-93), Spanish-American author, was born in Mexico, Dec. 22, 1859. His early writings were signed by many pseudonyms, of which *el Duque Job* became universally known. Deeply romantic by nature, he was plunged into the maelstrom of modern thought, and was one of the precursors of the modernist period. The passion of his quest vibrates in his verses, revealing the poet now soothed by resignation, now calmed by renunciation, now blasphemous with despair, and never completely satisfied. In his prose he was no less the innovator. Out of the oratory of a Castelar, the bitter-sweet philosophy of a Campoamor, the romantic extravagance of an Echegaray and the tenderness of an Alfred de Musset he fashioned a highly original medium of expression. Gutierrez Najera died in Mexico, Feb. 3, 1893.

GUTNIAN, a distinct Scandinavian dialect of the GERMANIC stock of INDO-EUROPEAN spoken on the island of Gothland, and in its most ancient form often regarded as a separate language. For the study of its early period there are several hundred runic inscriptions, a runic calendar, the codified law of the island, of about 1350, and a fragment of a chronicle.

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GUTTA, in architecture, a small pendent ornament, conical or cylindrical in shape, and usually one of a series, which is carved on the lower side of the mutules of a Doric cornice or elsewhere in the entablature.

GUTTA PERCHA, a milky exudation from incisions made in the gutta percha trees (of the order *Sapotaceae*) found in the Malay Peninsula, Borneo and adjacent islands. The juice soon solidifies when exposed to air to a brownish mass which is tough and inelastic when cold but becomes soft and plastic when heated to nearly the boiling point of water. On recooling it again becomes hard, but not brittle like other resins or gums. It is waterproof, resistant to dilute acids and alkalis and a non-conductor and has been used as a waterproofing and insulating material. It is soluble in carbon disulphide, chloroform and light petroleum naphtha. If heated in a vacuum gaseous and liquid products are obtained similar to those obtained by heating RUBBER. It burns in air with a smoky flame and odor similar to burning rubber.

GUTTENBERG, a town of Hudson Co., N.J., located on the top of the Palisades overlooking Manhattan Island approximately opposite 80th Street. It is served by numerous bus lines connecting directly with both the 42nd Street and 125th Street ferries. While mainly the residence of workers in New York City, it has several local industries including embroidering, knitting and the manufacturing of drawing materials. It received its charter as a town in 1859. Pop. 1920, 6,726; 1930, 6,535.

GUY MANNERING, the romance of an abducted heir, by SIR WALTER SCOTT, published 1815. Guy Mannering, a young Englishman traveling along the wild coast of Galloway between 1750-70, introduces the reader to the circumstances surrounding the disappearance of Henry Bertram, last heir of Ellengowan. The story of how the hero is rescued from a band of smugglers and the designs of a crafty lawyer—chiefly through the efforts of Meg Merrilies, a gypsy woman—makes an exciting novel. Two conspicuous minor characters are Dirk Hatteraick, the villainous smuggler-captain, and Dominie Sampson, the abstracted old tutor of Ellengowan.

GUYNEMER, GEORGES (1894-1917), French war-time aviator, was born at Paris, Dec. 24, 1897. During the World War he became one of the most famous of the French airmen due to his daring. He flew alone, acting as both pilot and gunner, and was credited with bringing down 52 German planes. While engaged in a flight over Poelcapelle in Flanders on Sept. 11, 1917, he encountered a superior number of enemy planes, and was shot down and died in the crash of his plane. An account of his exploits during the World War is contained in *Le chevalier de l'air,* published in 1919 by H. Bordeaux.

GUYON, JEANNE MARIE BOUVIER DE LA MOTHE (1648-1717), French author and mystic, was born at Montargis on Apr. 13, 1648. She was educated in convents. In 1664 she was married to the wealthy Guyon, and upon his death in 1676 was left financially independent. Falling under the influence of Father Lacombe, a follower of Molinos and his doctrine of QUIETISM, she plunged into mysticism, and began in 1681 a series of journeys through southern France for propagating quietism. She was arrested in 1688, but freed through the help of the Duchess of Bethune, and was introduced into the court circle of Madame de Maintenon, where the doctrine of quietism had a profound effect. But further suspicion was cast upon the doctrine of which she and Fénelon, her chief convert, were champions, so that she asked Bossuet, the ecclesiastical giant of the day, to decide whether her writings were right or wrong. This began the famous disputes between Bossuet and Fénelon which lasted two years and brought Fénelon's repudiation by the Pope and which led to the death of quietism. In the course of it Mme. Guyon was imprisoned in the Bastille. From 1703, when she gained her freedom, until 1717 she lived a pious life of good works. She died on June 17, 1717.

GUZMAN BLANCO, ANTONIO (1829-99), President of Venezuela, was born in Caracas, Feb. 29, 1829, the son of Antonio Leocadio Guzman, the founder of *El Venezolano.* He became vice-president under Venezuela's first Federalist Constitution in 1864, was driven out by the Conservatives, but returned to lead a Liberal revolution in 1868 and made himself master of the country. He was elected constitutional President in 1873 and until 1888 was the real ruler of Venezuela. By some considered tyrannical and by others a wise ruler, he brought peace and prosperity to his people even though he personally became ex-

tremely wealthy. By means of high taxes he built railroads and fostered the cultivation of coffee and cacao. Later he abolished the export duties and reduced those on imports. He restored the credit of the country and made many improvements. He was the Grand Master of the Masonic Order, stripped the Catholic Church of its power and invited in Protestant missionaries. He spent every other term in Europe, governing the country through a henchman. He was instrumental in the writing of two constitutions, one in 1874 and the other in 1881. Guzman Blanco's name was attached to anything remotely connected with his régime, as part of a cult he had fostered. In 1888 the nation tired of his rule and turned against him, and he remained in Paris, where he died in 1899.

GWALIOR, a native state of British central India, embracing an area of 26,382 sq. mi. The surface of Gwalior is mountainous and the state is traversed by the Tapti, the Nerbudda, the Chambal and innumerable smaller rivers. The soil is fertile, producing wheat, maize, rice, cotton, tobacco, sugar-cane, millet and other crops. Cotton spinning is the main industry. Gwalior, with a population of about 80,000, is the capital of the state, which is governed by a native maharajah. A resident represents the British Government of India. Hindus comprise the majority of the inhabitants. Pop. 1921, 3,195,476; 1931, 3,520,708.

GWINNETT, BUTTON (c. 1735-77), American patriot, was born in Gloucester, England, probably in 1735. Having received a moderately good education, he became a merchant in the city of Bristol about 1756. He then came to America, settling first in Charleston, S.C., and later in Georgia before 1765. He was one of the signatories of the Declaration of Independence, became president of the Provincial Council of Georgia in 1777, and was one of the great landholders of the colony. He fought a duel with Gen. Lachlan McIntosh, was fatally wounded and died on St. Catherine's Island, May 19, 1777. His autographs are extremely rare, and collectors of the signatures of the Declaration signers have forced their value to a high figure.

GYMNASIUM, originally the Greek training school for youths competing in the public games; in its modern form an indoor rectangle or oval, equipped with a variety of appliances, as dumb-bells, horizontal-bars, rings, and vaulting-horse, for gymnastics. In Germany *gymnasium* is used to denote the classical secondary schools.

The Greek training school was generally an outdoor space for games and exercises, enclosed by colonnades, terraces and trees. The history of the modern gymnasium dates from about the middle of the 19th century, when the value of systematic physical exercise (*See* CALISTHENICS, GYMNASTICS.) was recognized in maintaining health. Gymnasiums appeared throughout Europe, and gymnastic societies were established in all parts of the United States. The impetus thus given toward revival of the popular institution of the Greeks resulted in the construction of gymnasiums in elementary and secondary schools, and at colleges. A physical instructor, trained at a school of gymnastics, is generally employed to supervise the work of the pupils, who under many educational systems receives scholastic credits for periods spent in the gymnasium. In the United States the work of the Young Men's Christian Association has done much to popularize the gymnasium.

GYMNASTICS, physical exercises practiced generally indoors in a GYMNASIUM with or without gymnastic apparatus, are of Greek origin. The Greek gymnasium was a training school where youths prepared for the public games. In the modern sense, gymnastics comprise a series of systematic exercises, designed to promote health and cure physical defects. As the term is used to-day, gymnastics are of comparatively recent origin. In 1825 Charles Follen and Charles Beck attempted to introduce German physical exercises into the United States; but public interest remained apathetic until after 1848, when thousands of Germans, emigrating to America after the Revolution, organized gymnastic societies. Meanwhile in Europe and England there was growing recognition that gymnastics in the schools could produce beneficial results on an impressive scale. In time indoor physical exercises, calculated to develop a normal physique, became obligatory, as to-day in the United States, France, Germany and Italy, or optional, as in England, Denmark and elsewhere, in the elementary and secondary schools.

The growth of interest in gymnastics is evidenced by the individual development of systematic exercises in a number of countries. Thus there are Swedish gymnastics, usually without apparatus, and emphasizing free movement of the limbs; German gymnastics, performed on a variety of appliances; Danish gymnastics which include TUMBLING and Rope-Climbing. Variations and combinations of these exercises and improvements are seen in Russian, Swiss, Italian, Spanish, Finn and American gymnastics.

The more common apparatus for those gymnastic exercises requiring appliances are the dumb-bell, barbell, Indian club, skipping rope, pulley-weights, vaulting horse, horizontal bar, parallel bars, trapeze, and the swinging rings. In the United States home gymnastics on ingenious machines providing exercises for various parts of the body have enjoyed moderate popularity. *See* CALISTHENICS; PHYSICAL CULTURE.

GYMNOSPERMS, a small group of flowering plants that bear naked ovules and pollen, often between the scales of a cone. They are considered the simplest of all flowering plants, being the probable progenitors of the ANGIOSPERMS which have their ovules enclosed by an ovary. Although once the dominant plants on earth, they are now represented only by the CONIFERS, the CYCADS, the GINKGO and the family *Gnetaceae*, of which the two first are by far the most numerous. The ancestors of the gymnosperms formed a large part of the forests from which coal was formed. N. T.

GYÖR or **RAAB,** a city in Hungary, seat of the county of the same name which consists of the ves-

tiges of the former counties of Moson and Pozsony left to Hungary by the Treaty of Trianon. Györ serves as a railroad center and station for the Danube steamers. Situated at the confluence of the Rába River and the Little Danube; it was once strongly fortified and has many dikes and five bridges. There are eight Catholic, two Protestant and a Greek-Oriental church, a city hall and other public buildings, advanced schools and renowned horse fairs. Györ is the seat of a Roman Catholic bishop, a Protestant superintendent, and a cathedral chapter. The many factories produce potash, soda, margarine, oil, matches, flour, machines and railroad cars. The city is built upon the remains of the Roman colony, Arrabona, and was a center of the realm of the Avars, of which Charles the Great made an end. King Stephen the Saint, the first Hungarian king, founded a bishopric here and fortified the city. Near the end of the 16th century it was betrayed by the Turks, but was recaptured. Pop. 1930, 50,977.

GYPSUM, a soft, white mineral of pearly or silky appearance, used in art and industry. It frequently occurs in limestone in well-formed monoclinic crystals, so twinned as to resemble arrowheads, and is also found as massive, sedimentary beds. The crystalline, transparent variety is called SELENITE, and SATIN SPAR is delicately fibrous with a silky luster. Satin spar is sometimes used in cheap jewelry, as in the "luck stones" sold at Niagara Falls, N.Y. ALABASTER is a translucent, finely granular gypsum used for ornamental carvings, boxes and vases. Gypsum is a hydrous calcium sulphate.

The principal use for gypsum is in structural materials. When calcined to drive off some of the water of crystallization, it becomes a white powder which will set hard on re-absorbing water. This is plaster of Paris, used in making wall plasters, plaster boards, blocks, tiles and Keene's cement, used for statuary. It also serves as a retarder in Portland cement. Another use of gypsum is as a fertilizer, under the name "land plaster." Minor uses are as polishing material, in white pigments, dental plaster, and as a filler for cotton goods.

The commercially important deposits of gypsum have formed as chemical precipitates from evaporating salt water in enclosed arms of the sea or inland basins. France, Canada, and Great Britain are the principal foreign producers, but the largest is the United States, derived mostly from New York, Iowa, Michigan, Ohio, Texas and Oklahoma. *See also* PLASTER; PORTLAND CEMENT; MONOCLINIC SYSTEM; DEPOSITS; SAND; MINERALOGY.

GYPSUM PLASTER is made by partial or complete dehydration of natural gypsum. The setting of these plasters is a recrystallization from a solution formed by a mixture of the material with water, reforming the original substance. Where gypsum is heated to a temperature between 250° and 400° F., it loses about three-fourths of its combined water and the calcined product is known commercially as "Plaster of Paris."

As found in nature, gypsum contains impurities. If these impurities or substances, such as fiber added for the purpose, are present in the calcined product, they retard setting; and such gypsum plasters are termed "slow setting." Gypsum plasters may be either slow or fast setting, and are sometimes incorrectly referred to as cement plasters.

By calcining gypsum above 900° F. a very hard flooring plaster is produced, which sets very slowly. *Keene's cement* is obtained by calcining pure gypsum at red heat, immersing it in an alum bath, then drying and calcining it again. *Mack's cement* is dehydrated gypsum mixed with 0.4% of sodium or potassium sulphate. This plaster takes a quick, hard and durable set, and is used for floorings or for stuccoing on walls and ceilings. G. A. H.

GYPSUM PRODUCTS, forms of building products which are made from calcined gypsum mixed with various materials such as fiber, woodpulp, etc. They are molded as units by various processes and supplied ready to place on the job as gypsum "plaster board"; gypsum "wall board"; gypsum partition tile or block; gypsum roof tile. *See also* GYPSUM PLASTER.

GYPSY LANGUAGE. *See* ROMANY.

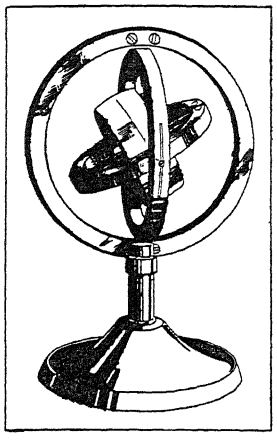
GYPSY MOTH, a European insect of the family *Lymantriidæ,* which has become a serious pest in New England. Its large hairy caterpillars defoliate deciduous and evergreen trees. When three-fourths grown the caterpillars usually feed at night and hide in masses during the day. The whitish, heavy bodied females are unable to fly. The males are dark, and fly about wildly in the daytime. On tree trunks and branches they lay masses of eggs covered with hairs from their bodies. Caterpillars hatch in May. Immense sums of money have been spent by federal, state and municipal governments to delay the spread of this pest. Egg masses are coated with creosote to destroy them. Lead arsenate spray is used in the spring. Tall trees are banded with burlap to trap the caterpillars and trunks of evergreens smeared with sticky material to prevent their ascent.

GYRFALCON, a group of large birds of prey inhabiting arctic regions and the colder parts of the north temperate zone, occasionally wandering as far south as northern United States in winter. They are about 2 ft. long and in color range from very dark to almost pure white. Though less spirited than the famous peregrine falcon, they are more swift and powerful, preying chiefly upon ptarmigan, grouse, water-fowl and hares. There are several forms, of which the white gyrfalcon (*Falco rusticolus caudicaus*) and the black gyrfalcon (*F. rusticolus obsoletus*) are among the best known. The gray gyrfalcon is but a color phase of the white. Gyrfalcons were formerly employed in Europe for hawking and are still so used by Mongolian peoples. *See also* FALCON.

GYRO-COMPASS, a compass based upon the principles of the GYROSCOPE; it was first developed by ELMER A. SPERRY. The gyro-compass is independent of magnetic disturbances and indicates geographic north. It has been widely adopted for use in ship and

aircraft pilotage. It operates as a result of reaction between a gyroscopic wheel and the earth's motion and gravitation.

The principle of the gyro-compass may be demonstrated by a gyroscope mounted as shown in the accompanying figure. With the wheel spinning, hold the base of the gyroscope upright and hold the intermediate ring. Turn around slowly (rotating with the body as an axis). The axis of the gyroscope will move into a position parallel with the body, the wheel always rotating in the same direction as the body. In this simple experiment, the rotation of the body corresponds to the rotation of the earth on its axis; the effect of holding the intermediate ring is obtained by the force of gravity. The axis of the gyro-compass maintains itself parallel to the axis of the earth just as the gyroscope axis remains parallel to the axis of the body.



GYROSCOPE

With three ring mounting to demonstrate gyro-compass and airplane stabilizer applications of the gyroscopic principle

The use of the gyro-compass has been further extended to permit automatic steering of ships on a predetermined course, this apparatus being popularly termed "Metal Mike."

GYROSCOPE, a mechanism comprising a heavy, rimmed wheel mounted in Gimbals so that it is free to rotate in any direction. The gyroscope became of interest to science through its peculiar phenomena of motion, and it has been put to many practical applications.

The two principles upon which its action depends are termed *rigidity in space* and *precession*. Rigidity in space may be defined as the tendency of a body to remain fixed in its plane of rotation, an exemplification of the laws of INERTIA. This property is marked because of the high inertia of the mass concentrated at the rim of the wheel and the high rate of rotation. A gyroscope carried on the surface of the earth will rotate with respect to the earth, making one revolution in 24 hours, but, with respect to space, it remains fixed. Precession is the motion of the gyroscope when a torque is applied to it. The gyroscope resists this torque and rotates about an axis perpendicular to the axis of the applied force until the plane of rotation is in the plane of the force. If the plane of the torque rotates with the instrument, as when a weight is suspended from one end of the horizontal axis of the wheel, the rotation will be continuous.

The practical applications to which the gyroscope has been put include: the gyro-compass, which is independent of magnetism; marine gyroscope stabilizers, which prevent ships from rolling about a horizontal axis; airplane stabilizers or automatic pilots; steering devices for ships; roll and pitch recorders for ships; track recorders for determining the variations in a railway road-bed and track levels; turn indicators; and steering devices for torpedos. In all these applications the wheel of the gyroscope is rotated by an electric motor, and, in the case of stabilizers, the plane of rotation is so controlled that the force tending to roll the ship is in opposition to the direction of natural roll. *See* AIRPLANE STABILITY AND CONTROL.

H

HAAKON VII (1872-), King of Norway, was born at Charlottenlund, Denmark, Aug. 3, 1872. He was the second son of King Frederick VIII of Denmark and until he became King of Norway, he was Prince Carl of Denmark. He was educated as a naval officer and attained the rank of captain. On July 22, 1896, he married Princess Maud, daughter of King Edward VII of England. When the throne of Norway became vacant through the dissolution of the union between Norway and Sweden in 1905 he was chosen king of Norway by popular election and was crowned in Trondheim Cathedral, June 22, 1906, taking the name of Haakon. In accepting the Norwegian crown, he renounced all claim to the throne of Denmark. King Haakon and Queen Maud have one son, Olav, who has been officially accepted as the Crown Prince of Norway.

HAARLEM, capital of the Dutch province of North Holland, located 3¾ mi. from the North Sea and divided into two parts by the Sparne River. Of the 15 churches, the *Groote Kerk,* with a magnificent late-Gothic basilica, is foremost. The city hall, once occupied by the Flemish counts, contains many portraits by FRANS HALS and a rare collection of old prints. The Princes' Court is now a meeting-place of the provincial legislature and contains the municipal library and governmental offices. Haarlem has many schools and an art institute, a Bible museum, the Dutch Scientific Society, and the first printing-house in the Netherlands, home of the oldest newspaper for more than two centuries. There are a large cotton factory, iron and copper foundries; and the capital is famous for its cultivation of flowers. Haarlem is also the seat of a Roman Catholic and a Jansenist bishop. Originally a village with a count's castle, it became a city in 1492. The Spaniards besieged it for seven months in 1572-73, a number of women of the city aiding in the defense. The city flourished in the 17th century after the arrival of the French emigrants, but since then has declined. Pop. 1930, 119,851.

HAARLEM, SIEGE OF, an episode in the revolt of the Netherlands. For seven months in 1572-73 the Calvinist town, with a garrison of 4,000, stubbornly resisted the attacks of 30,000 Spanish. Intolerance and cruelty marked the struggle on both sides. When starvation finally brought surrender, a heavy fine was exacted from the survivors after the remaining Dutch soldiers had been butchered, their leaders hanged, and 400 citizens put to death.

HAARLEMERMEER, formerly a lake 14 mi. long, 7 mi. wide and nearly 15 ft. deep, located in the Dutch province of North Holland between Haarlem, Leiden and Amsterdam, near the North Sea. Originally there were 4 lakes in its place, but in the course of three centuries the area of water tripled and became threatening. From 1840 to 1853 it was drained at a cost of $6,000,000 and now forms an island surrounded by a canal. On the former lake bed are scattered communities which form the parish of Haarlemermeer. Pop. 1930, 26,970.

HAASE, HUGO (1863-1919), German Socialist leader, was born in East Prussia, Sept. 29, 1863. He was a Social-Democratic member of the Reichstag in 1914 and as such was bitterly opposed to the World War. He later identified himself with the Independent Socialists and in 1918 assisted in forming the first revolutionary government. He was assassinated while entering the Reichstag Building, Nov. 7, 1919.

HABAKKUK, BOOK OF, one of the minor prophetical writings of the Old Testament, is named after a prophet, who is said to have preached from 609 to 597 B.C. We know practically nothing of his personality; but he is a frequent subject of legend. In the apocryphal *Bel and the Dragon* he is carried through the air by an angel from Judah to Babylon to feed Daniel. The three chapters of the book treat of the general wickedness of the people, and the growing menace of the Chaldeans. The third chapter is a lyric ode showing the Deity in judgment and is one of the finest examples of Hebrew poetry.

HABEAS CORPUS, in law, a proceeding to decide whether a person is lawfully deprived of his liberty. A "writ" of Habeas Corpus is directed to some officer of the law or even a private person having another in custody requiring him to produce, at time and place mentioned, the body of the one who is held together with a statement of the grounds on which he is held.

HABER, FRITZ (1868-), German chemist, was born at Breslau, Dec. 9, 1868. In 1906 he became professor at Karlsruhe and in 1911 was a member of the physical and chemical section of the Kaiser Wilhelm Gesellschaft at Berlin. Here he devoted himself to organic and physical chemistry and discovered the synthetic production of ammonia. During the World War he was invaluable in organizing the German chemical industry. In 1918 he was awarded the Nobel Prize in chemistry.

HABINGTON, WILLIAM (1605-54), English writer, was born at Hindlip Hall, Worcestershire, Nov. 4 or 5, 1605. He was educated at the College of St. Omer, and went to Paris. His courtship of Lord Powys's daughter Lucy, and his marriage to her, inspired *Castara,* a series of poems. With other editions of this work were included elegies, later lyrics and devotional pieces. Habington also wrote a *Historie of Edward the Fourth, The Queene of Arragon,* a tragi-comedy, and *Observations upon History.* He died Nov. 30, 1654, and was buried at Hindlip.

HABIT, an acquired mode of response. It is thus set over against inherited reaction patterns, until recently known as instincts. Habit is second nature. It represents a great economy in the adaptive process. Acts which originally require considerable attention for their performance may be reduced to the habitual level. Here they become automatic and take place without thought. If we had to think about all the countless things we do by habit in the course of the day's routine, we would never find any time to think or for the pursuits in which we are most interested. Such things as walking, talking, eating and dressing are all habits. If we begin to think about our speech we are apt to stammer or if we begin to think about our walking we are liable to stumble. We get along much better when such processes are left to the rôle of habit.

But habit may become tyrannical. It represents the customary, and because it is easy, it is pleasant to exercise habit. Thinking requires much more effort. In order for experience to grow habits must not enslave. Constantly to be on the alert for new experiences means that habit must be kept in its place. It has a real function to perform, but so has intelligence. Intelligence introduces the new, habit preserves the old part of experience.

HABITAT, the place or places where an organism normally occurs. Biologists writing in Latin, for example, Linnæus, were in the habit of introducing the sentence giving the occurrence with the word *habitat,* "it is accustomed to inhabit." From this, later workers came to use the word as a noun. Properly the word should be restricted to customary occurrence, rather than to single records, but this has never been consistently done. More recently there has been a tendency to use the word in botany especially of the kind of locality where the plant occurs, such as swamp or mountain, while in zoology it is used more in a purely geographical sense. Linnæus used it broadly and might say either *"Habitat in Germania"* (it lives in Germany) or *"Habitat in Betula"* (it lives on birch).

Habitat should be distinguished from locality, which is used for the place where a given specimen was obtained, and from station which is the limited place where a colony of a species may be found more or less continuously. Distribution also implies a more complete knowledge and statement of the area which a species covers, while habitat, though it implies customary occurrence, does not so definitely imply completeness of statement. W. T. M. F.

HABITUAL OFFENDERS, individuals who repeatedly commit crime and whom the usual channels of law cannot adequately reach. In 1908 the Prevention of Crime Act empowered the British Courts to give a sentence of preventive detention, in addition to one of penal servitude. In the United States the laws regarding these offenders vary with almost every state, in some being so severe, e.g., New York, as to make it mandatory for the judge to sentence the offender for life.

HABSBURGS or HAPSBURGS, the royal family of Austria and Hungary prior to the revolutions of 1918. The birthplace of this line of emperors was the now ruined castle of Habsburg near Königsfelden, Switzerland. Founded by Guntram the Rich in the 10th century, the family came to the front when RUDOLPH I (1218-91) was chosen king of the Germans in 1273. He conquered Austria, Styria and Carinthia. In the next century Tyrol was added to the Habsburg domains. The great territorial aggrandizement came in the 15th and 16th centuries when, through marriage and inheritance, the Habsburgs acquired the Burgundian lands west of the Rhine, Spain, parts of Italy and the Spanish colonies overseas, while on the east they established claims to Bohemia and Hungary. In 1438 Albert II was crowned Holy Roman Emperor, which title remained with the Habsburgs almost without interruption until the Empire itself was dissolved in 1806.

The Habsburgs reached the peak of their power under CHARLES V, or Charles I of Spain. Upon his abdication in 1556 and the attendant partition of his territories between his son, Philip, and his brother, Ferdinand, the line divided into the Spanish and Austrian houses. The Spanish line died out in 1701; the Austrian line continued. Upon the loss of the Netherlands in the early 17th century the interests of the house were restricted to central Europe where it continued to play a dominating rôle in German and Italian affairs. The rise of Prussia and the establishment of the German Empire and the kingdom of Italy greatly curtailed both Habsburg territory and influence.

In 1804, two years before the dissolution of the Empire, FRANCIS II declared himself Emperor of Austria, being also King of Hungary. Although the Habsburgs ruled over territories torn by racial differences, Francis Joseph I was able to ride out the storm during his long reign. The World War, however, brought on the ruin of the house. The murder at Serajevo of FRANCIS FERDINAND, nephew and heir of Emperor Francis Joseph, was the immediate provocation for the war. The last emperor, Charles Francis Joseph was born in 1887, and died in 1922. He married Zita, Princess of Bourbon-Parma, and their eldest son, Francis Joseph Otto, heir to the Habsburg claims, was born in 1912.

HACHETTE, LOUIS CHRISTOPHE FRANCOIS (1800-64), French publisher, was born at Rethel, Ardennes, May 5, 1800. He began as a teacher, then studied law, but became a publisher in 1826, first bringing out manuals, dictionaries, and editions of the classics. After 1850 he gave his business wider scope, although keeping always within the field of general education. The Hachette series of guide-books and illustrated handbooks of architecture, history, science, etc., have been especially celebrated. He was one of the earliest advocates of international copyright laws. He died at the chateau of Plessis-Piquet, July 31, 1864.

HACHURE. *See* MAPS AND MAPPING.

HACKBERRY (*Celtis occidentalis*), called also nettle-tree and sugar berry, a handsome tree of the elm family, native to river valleys from Quebec southward to Florida, and ranging westward to Texas and Oregon. It grows usually 40 to 50 but sometimes 120 ft. high, with widespreading often pendulous branches forming a round-topped head. In foliage it resembles the elm but differs in its fruit which is a dark purple, thin-fleshed berry-like drupe, ripening in autumn. The hackberry is frequently planted in the Mississippi Valley as a shade and ornamental tree. The heavy, rather soft wood is used sparingly for fence lumber and in the manufacture of furniture.

HACKENSACK, a city and the county seat of Bergen Co., N.J., located on the Hackensack River, 5 mi. northwest of the New Jersey terminus of the George Washington Memorial Bridge. The city occupies a site for the most part level but rising in the northern part to a height which affords a fine view of the Metropolitan district. It is served by the Erie and Susquehanna railroads and motor bus lines. Hackensack is mainly a residential community, but has a number of local manufacturers. In 1929 the value of the factory output was about $4,600,000; the retail trade amounted to $22,848,601. Hackensack was settled by the Dutch around 1640 and there are many fine examples of Dutch Colonial architecture still standing. It was granted its charter as a city in 1868. Pop. 1920, 17,667; 1930, 24,568.

HACKETT, FRANCIS (1883-), Irish-American journalist and writer, was born in Kilkenny, Ireland, Jan. 21, 1883, and was educated at Clongowes Wood College, Kildare. He came to America in 1900, became editorial writer for the Chicago *Evening Post,* 1906-09, and conducted the literary review for that paper. He was associate editor of the *New Republic,* 1914-22. Among Hackett's works are *Ireland: A Study in Nationalism,* 1918, *Horizons,* 1918, *The Invisible Censor,* 1920, *The Story of the Irish Nation,* 1922, *That Nice Young Couple,* 1924, and *Henry VIII,* 1929.

HACKETT, JAMES HENRY (1800-71), American actor and manager, was born at New York City, Mar. 15, 1800. He made his first appearance on the stage in 1826. He became noted as an actor of humorous parts, among which were Justice Woodcock, Sylvester Daggerwood, Monsieur Morbleau, Dromio, Rip Van Winkle, Nimrod, Wildfire and Sir Pertinax McSycophant. He first played his greatest part, Falstaff, in association with Charles Kean, as Hotspur, at the Arch Street Theatre, Philadelphia, in 1832. He became manager of the Chatham and Bowery theaters, and of the Astor Place Opera House at the time of the riot in 1849; he wrote *Notes and Comments on Shakespeare,* 1863. Hackett left the stage May 21, 1870, and died Dec. 28, 1871.

HACKETT, JAMES KETELTAS (1869-1926), American actor, was born at Wolfe Island, Ont., Canada, Sept. 6, 1869. He was the son of JAMES HENRY HACKETT, also an actor, and made his début in 1892. He was leading man at the Lyceum Theatre, New York, 1896-99. Later he became an independent producer. Hackett's greatest personal success was *The Prisoner of Zenda,* 1896. His *Macbeth* won high praise in London, 1920, and after his performance at the *Odéon,* Paris, he was decorated with the ribbon of the Legion of Honor. He died at Paris, Nov. 8, 1926.

HACK SAWS, thin saw blades made especially for cutting metals. They are used either in small hand frames or in machines. Originally used in emergency jobs where a special machine was unavailable, the hack saw has modernly found a place in almost every metal working plant. While the emergency or hand hack saw is still necessary, the power hack saw has become standard shop equipment. Metal cutting BAND SAWS, which are simply continuously acting hack saws, are also widely used.

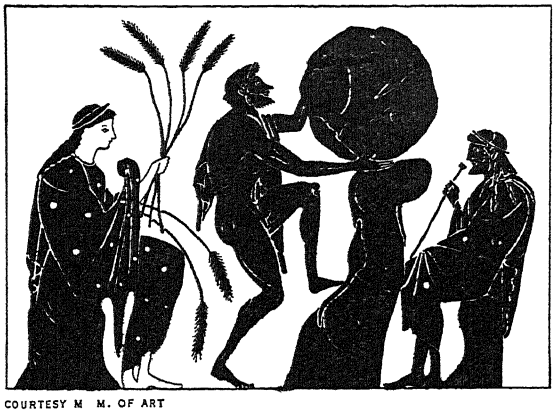
HADDOCK (*Melanogrammus aeglifinus*), an important food fish of the COD family, abundant on both shores of the North Atlantic and ranging southward in the New World to the deep water off Cape Hatteras. Although closely resembling the cod, the haddock is readily distinguished by its black lateral line and a black spot over each pectoral fin. It is also smaller than the cod, usually weighing 3 or 4 lbs., although a specimen weighing 24½ lbs. has been recorded. The haddock moves near the bottom in large schools, is an omnivorous feeder though preferring mollusks and crustaceans, and is very prolific, a female often laying a million eggs. The flesh of the haddock is firm and keeps well, ranking in quality with the cod, and, when smoked, is the finnan haddie of commerce. Haddock fishing is an important industry on both sides of the Atlantic. In 1929 the catch in United States waters was 261,653,000 lbs., valued at $9,142,000; in Canadian waters, 545,409 cwt., valued at $1,052,563.

HADDONFIELD, a residential borough of Camden Co., N.J., located 7 mi. southeast of Philadelphia, Pa. It is served by the Pennsylvania Railroad and numerous motor bus lines. While mainly a suburb of Philadelphia and Camden it has several important local industries including the manufacture of pottery and nautical instruments. Haddonfield featured prominently in Colonial and Revolutionary affairs and was the meeting place of the Revolutionary New Jersey legislature in 1777. In one of the city parks are located some of the first few trees planted in America, brought from England in 1712. Haddonfield was settled at the instigation of Elizabeth Haddon around 1701 and was incorporated as a borough in 1875. Pop. 1920, 5,646; 1930, 8,857.

HADDON HEIGHTS, a rapidly growing borough of Camden Co., N.J., located 8 mi. southeast of Philadelphia, Pa. It is served by the Reading Railroad and motor bus lines. Strictly a residential community, it is a popular suburb for many Philadelphia and Camden business men. Pop. 1920, 2,950; 1930, 5,394.

HADES, in Greek mythology, the region of the dead and also another name for Pluto or Dis, the

god who presided over this region. Pluto, son of CRONUS and RHEA, governed his dark kingdom from a throne of sulphur from which flowed the rivers of the lower world, the Cocytus, Lethe, Acheron and Phlegethon. The wife of Pluto was PERSEPHONE. The



COURTESY M M. OF ART

SISYPHUS IN HADES
From a 5th century amphora

palace of the king of Hades was guarded by the watchdog CERBERUS, who allowed spirits to enter but none to depart.

HADFIELD, SIR ROBERT ABBOTT (1859-), British metallurgist, was born at Sheffield, Nov. 29, 1859. At an early age he showed a remarkable understanding of the working of metals, and at 25 devised new means of manufacturing manganese steel. This was followed by other inventions and improvements in processes of producing alloys, for which he received recognition from scientific societies. He became chairman of Hadfields, Ltd., and director of other prominent companies. In 1917 he was created baronet. *Metallurgy and Its Influence on Modern Progress,* published in England by Hadfield in 1925, and the following year in the United States, is an outstanding reference in its field.

HADING, JANE (1859-), French actress whose real name was Jeanne-Alfrédine Tréfouret, was born at Marseilles, France, Nov. 25, 1859. She appeared on the stage at three, but later studied dramatic art at the Marseilles Conservatoire. She sang in operetta and played in *Ruy Blas* in her native town. Her Paris début was in *La Chaste Suzanne.* Other important rôles were in *Le maître de fôrge,* 1883, *Les Effrontés, Les Demi-Vierges* and *La Pompadour.* She later became a member of the *Comédie Française.*

HADLEY, ARTHUR TWINING (1856-1930), American educator and economist, was born at New Haven, Conn., Apr. 23, 1856. Following his graduation from Yale University in 1876, he studied political science there for a year and from 1878-79 at the University of Berlin. He returned to Yale as a tutor in 1879, was lecturer on railroad administration 1883-86 and from 1886-99 was professor of political science and political economy. In 1899 Hadley was elected president of the university, serving until 1921, when he was made president emeritus. He reorganized the university on departmental lines and developed both the Graduate and Professional schools. Distinguished as an educator, Hadley was equally well known as an economist. His *Railroad Transportation: Its History and Laws,* 1885, brought him quick recognition as an authority on the subject. He was Commissioner of Labor Statistics in Connecticut from 1885-87 and the following two years was associate editor of *Railroad Gazette.* He was Roosevelt professor of American History at the University of Berlin 1907-08. Hadley died at Kobe Harbor, Japan, Mar. 6, 1930.

Among his writings are *Economics: an Account of the Relations Between Private Property and Public Welfare,* 1896; *Standards of Political Morality,* 1907; and *Economic Problems of Democracy,* 1923.

HADLEY, HENRY KIMBALL (1871-), American music composer, was born at Somerville, Mass., Dec. 20, 1871. He studied violin and theory at Boston and Vienna. Returning from Europe in 1905, he held various professorial posts in American schools. In 1909 he was appointed Kapellmeister at the Mainz Opera, where his opera *Safie* was produced. He has conducted many American orchestras, and has been guest conductor at Buenos Ayres, Stockholm, Amsterdam, and London, where he produced his choral work *Resurgam.* He has written symphonies, numerous songs and much chamber music, besides cantatas, lyric dramas and the opera, *Cleopatra's Night.* In 1931 he became conductor of the Manhattan Symphony Orchestra of New York City.

HADRIAN. PUBLIUS AELIUS HADRIANUS (76-138 A.D.), Roman Emperor (117-138). After a distinguished civil and military career he was adopted as successor by TRAJAN, emperor from 98 to 117. Abandoning Trajan's conquests beyond the Euphrates, he reverted to AUGUSTUS's policy of consolidating the frontiers rather than of pushing them forward. He devoted many years to journeys through all parts of the empire. His interest in the provinces is witnessed by his foundation of towns and construction of roads, aqueducts and public buildings. He checked the abuses of tax-farming by introducing a system of direct levy by procurators responsible to himself. He revised the administration of justice and finance in Italy and developed a permanent civil service. A wise and humane ruler, although somewhat too lavish in his expenditures, the great wall bearing his name which crosses England from the Solway to the Tyne and which defended Roman Britain from Caledonian attacks, and his mausoleum in Rome, remodeled and now known as the castle of St. Angelo, are striking memorials of his activity.

HADRIAN'S WALL, a rampart built by the Romans to defend the northern boundary of their province in Britain, and extending from Bowness on Solway Firth to Wallsend-on-Tyne, a distance of about 75 mi. It was erected in 122-126 by order of the Emperor Hadrian, and was used by the Romans until nearly the end of the 4th century. The wall was some 18 ft. high and from 6 to 10 ft. thick. Small forts,

called milecastles, were erected at intervals of one Roman mile, and between these were placed about 320 smaller watchtowers. On the south side was probably a military road, beyond which was an earthen mound or *vallum*.

HADRUMETUM, in ancient geography, a town and seaport of Africa, believed to have occupied the present-day site of Susa in Tunisia, on the southwest shore of the Gulf of Hammamet, 70 mi. south by east of Tunis and 75 mi. southeast of Carthage. The town was doubtless founded by Phenecians prior to the 9th century B.C. About 310 B.C. it capitulated to the tyrant Agathocles. In 202 B.C., following the Carthaginian defeat at Zama, the town was a shelter for Hannibal. After 146 B.C., which marked the end of Carthage as a Mediterranean power, Hadrumetum entered upon its Roman period, and under Trajan in the first Christian century enjoyed colonial status. In the 5th century Hadrumetum was demolished by Vandals but was restored to the Byzantine empire by Justinian about 531, and accordingly named Justinianopolis. In the Arab conquests of the 7th century the town was reduced to a stronghold of pirates, who made effective use of its sheltered harbor. Punic and Roman remains and a trace of Christian catacombs are found in the city.

HAECKEL, ERNST HEINRICH (1834-1919), German naturalist, was born at Potsdam, Feb. 16, 1834. Originally a physician, under the influence of Johannes von Müller he turned to biology, and in 1865 became professor of zoölogy at Jena. He remained there until 1909 making many scientific expeditions to Mediterranean countries and to Asia, where he collected valuable zoölogical data. Haeckel was one of the great naturalists of his time and one of the most prominent advocates of Darwinism in Europe, erecting on DARWIN'S theories of animal relationship an inclusive rigidly materialistic philosophy which sought to account for all the phenomena of life by a causal system on the fitness principle. His many writings as, *The Origin of the Human Race, The History of Creation, Popular Lectures on Evolution,* had a profound influence upon all the late 19th century materialistic philosophies and by their popularizing tendency furnished a scientific basis for the dramatization of these philosophies of HEBBEL, IBSEN and SHAW. Haeckel died at Jena, Aug. 9, 1919.

HAFIZ (c. 1325-88), Persian poet, whose real name was Shams-ud-din Mahammed, was born at Shiraz, about 1325. *Hafiz* is Persian for "one-who-remembers," indicating his memorizing of the Koran. Little is known of his life except that at an early age he became indoctrinated with the mystic tenets of Sufism and that he remained a lowly dervish all his life. Hafiz has been called the Persian ANACREON, and it has been well said of his lyrics that there is "no shadow in his sky, no discord in his music, no bitterness in his cup." Yet Hafiz was more than an Anacreon. His passionate love poetry must be interpreted much as Walt Whitman's is. (*See* WHITMAN, WALT.) He was a mystic without the usual ascetic auxiliaries; the mystic experience did not run away from life but embraced it in all its fullness. To Hafiz love and beauty could take earthly forms, and yet every vital experience had a divine significance. The nightingale and the rose were such divine symbols, and life itself was merely a stage in the journey towards ecstatic union with divinity. The poet died at Shiraz in 1388.

HAFNIUM, a metallic chemical element resembling ZIRCONIUM in its properties; symbol Hf, atomic weight 178.6. It was discovered by Coster and Hevesy in 1923 by spectroscopic methods. It occurs in nature practically always together with zirconium.

HAGEN, a German industrial city in the state of Westphalia, about 31 mi. northeast of Düsseldorf. It has large iron works and factories for metal goods. It belonged to the Cologne Electorate till 1392, later to the County of Mark. Pop. 1925, 99,736.

HAGERSTOWN, a city of northwestern Maryland, the county seat of Washington Co., situated about 6 mi. from the Potomac River and 72 mi. northwest of Baltimore. It is served by bus lines, the Western Maryland, the Baltimore and Ohio, the Pennsylvania and the Norfolk and Western railroads. There is a municipal airport. Located in the fertile Cumberland Valley, Hagerstown is a marketing center for wheat, hay, corn, fruit and vegetables. The local manufactures include furniture, cement, leather and leather goods, pipe organs and textiles. The factory output, 1929, was worth $22,514,770. In 1929 the retail business amounted to $19,207,234. The Crystal Grottoes of Maryland, noted for their beauty, are about ten mi. south of Hagerstown, and 12 mi. distant is the Antietam Battlefield, where a decisive battle of the Civil War was fought. Just before the Battle of Gettysburg, Gen. Robert E. Lee concentrated his forces in this city. Hagerstown was founded in 1761 by Capt. Jonathan Hager, on land granted him by Lord Baltimore; the city was incorporated about 1790. Pop. 1920, 28,064; 1930, 30,861.

HAGFISH, a name for several round-mouthed fishes (*Cyclostomi*) found in temperate waters, clinging to and devouring other fishes in a parasitic way. A well known hagfish (*Myxine glutinosa*), resembling an eel, reaches a length of 18 in. and is found on both Atlantic coasts. Its soft, sucking mouth is circled by eight tentacles. Two rows of teeth line the tongue. The body, lacking bones, consists of strong cartilage and membrane and a heavy glutinous substance is secreted through the smooth skin. Heavy skin over the eyes makes them almost invisible and useless. After attaching itself to another fish, the hagfish bores into the body, consuming every part of it, except the skin, skeleton, and nervous system. On the Pacific coast, the hagfish (*Polistotrema stouti*) causes great damage to fishes caught in nets.

HAGGAI, BOOK OF, one of the minor prophetical writings of the Old Testament, is known as the Book of Aggeus in the Douay Bible. The two brief chapters show that Haggai prophesied in Jerusalem about 520 B.C., and is sometimes called the "first

prophet of the restoration." Knowing little of his life, legend has filled in his story, and one tells us that Haggai was an angel in human form. The book contains four prophetic utterances, urging the erection of the "second" Temple, and pleads against the luxurious enjoyment of home life, while the House of God stands neglected.

HAGGARD, SIR HENRY RIDER (1856-1925), English novelist, was born at Bradenham Hall, Norfolk, June 22, 1856. He was educated in the Ipswich grammar school, went to Africa in 1875, and became Master of the High Court in the Transvaal. Returning to England he married, read and practiced law. His literary success was largely due to his fantastic imagination and his unusual African settings. *Dawn,* appearing in 1884, *King Solomon's Mines,* and *She,* in 1886 and 1887, were sensational successes. Haggard was interested in social colonization, and among serious works wrote *The Poor and the Land.* He was knighted in 1912, and died in London May 14, 1925.

HAGIOGRAPHY, that branch of sacred literature which deals with the lives and legends of the saints. Many of the *Acta* of Eusebius, the oldest collection, are incorporated in his *Ecclesiastical History.*

HAGUE, THE (Dutch **DEN HAAG**), residence of the queen and capital of the NETHERLANDS, also the capital of the province of South Holland, situated about 3 mi. from the North Sea, among the mouths of the Old Rhine and the New Maas, inside a chain of dunes. The city is well laid out and built with fine squares and extensive suburbs with country houses. In the center is the Binnenhof, built in 1250 with later additions, among them the Hall of the Knights with two towers, where the States General meets. The Hague was the seat of the Second Peace Conference in 1907 and of the Hague Conference of 1929-30. In the immediate neighborhood are remodeled government buildings of the 17th and 18th centuries. Adjoining the Binnenhof is a museum. Nearby is the Royal Picture Gallery with paintings by Rembrandt and other masters. Among the celebrated churches are the Groote (Great) or St. James Church of the 15th-16th centuries and the Nieuwe Kerk of the 17th century, containing the tomb of SPINOZA. On the Noordeinde Street is the Royal Palace and on the spacious Lange Voorhout is the palace of Queen Dowager Emma, and the Royal Library with 500,000 volumes. The industrial enterprises are located in the northern and eastern sections of the city. The many educational institutions include an academy for international law. The counts of Holland once held The Hague as a hunting preserve. In 1250, William, Count of Holland and German King, built a palace in the district. In the 16th century The Hague became the seat of the States General. Pop. 1930, including the village and sea bath Scheveningen and Loosduinen, 443,357.

HAGUE PEACE CONFERENCES, the two international conventions of 1899 and 1907, summoned at the instigation of Tsar Nicholas II of Russia to discuss armament limitation and arbitration, respectively. The first conference was held during May 18-July 29, 1899 and was attended by delegates from all the Governments with accredited representatives at Petrograd. The German delegates promptly objected to any discussion of arms limitation, a not unwelcome move to the delegations, save perhaps the Americans, for none of the countries were sincere in the promotion of disarmament. But despite this abandonment of a vital subject, a preeminently important step was made in the establishment of the International Court of Arbitration at The Hague, the predecessor of the Permanent Court of International Justice or WORLD COURT. It also prohibited the use of aerial bombing, gas shells and the hollow Dum-Dum bullets, and pronounced various strictures against unnecessarily cruel instruments of war. At the second conference, held during June 15-Oct. 18, 1907, and attended by delegates from 44 countries, declarations were adopted on the peaceful settlement of international differences, laws of war on land, rights of neutrals, the conversion of merchant ships into destroyers, submarine mines, naval bombardment, the establishment of an international prize court, and kindred subjects. As early as 1902-03, The Hague Tribunal proved its value by adjusting differences between the United States and Mexico, and between European signatories. In 1903 Andrew Carnegie donated $1,500,000 for the Palace of Peace, a meeting-place for the permanent court established by the first Hague conference. The palace contains a library devoted to international law.

HAGUE TRIBUNAL, the "permanent court of arbitration" created by the first Hague Peace Conference. The plan called for each signatory state to nominate four jurists for a six-year term. The names of these jurists were to be placed on a panel from which an arbitration tribunal might be drawn for the consideration of any case the parties might be willing to have arbitrated. Beginning with the Pious Fund Case, submitted by the United States and Mexico in 1902, tribunals were selected for a number of cases prior to the World War. F. M. R.

HAHNEMANN, SAMUEL CHRISTIAN FRIEDRICH (1755-1843), German physician, was born in Meissen, Saxony, April 10, 1755. He studied medicine in Leipzig and Vienna, and took his medical degree at Erlangen in 1779. As a result of experiments, some made on his own person, he formulated the theories which characterize the Hahnemann system of medicine. He believed that diseases or symptoms of diseases are cured by drugs which produce a similar pathologic effect on the body, and that drugs in comparatively small doses have a more dynamic effect than when administered in large doses. The latter theory was undoubtedly the cause of the popularity of Hahnemann's system at the time when it was introduced, since regular practitioners at that time used terrific doses of powerful drugs. He died in Paris on July 2, 1843. *See* HOMEOPATHY. M. F.

HAIDA, a North American Indian tribe and linguistic stock which is also called Skittagatan. The

Haida occupied the Queen Charlotte Islands, British Columbia, and the southern end of Prince of Wales Island, Alaska. Late in the 18th century they were first visited by whites who came to trade in furs and later established oil-rendering and salmon-canning factories. Like other tribes of the north Pacific Coast the Haida were excellent craftsmen in wood, building houses, carved house-posts, boxes and other utensils, and seaworthy dug-out canoes. Socially they were divided into two exogamous phratries, each composed of several matrilineal clans. Overlying this was a caste system of chiefs, noblemen, common people and slaves. Shamanism was well developed and pot-latch feasts were common.

HAIFA, a city of Palestine, situated 12 mi. southwest of Acre and the Bay of Acre at the base of Mt. Carmel. Haifa is the chief rival of Jaffa and handles the products of Trans-Jordania. Railways join the city to Egypt and Damascus. Pop. 1931, 50,533.

HAIG, DOUGLAS (1861-1928), 1st Earl of Haig and British general, was born at Edinburgh, June 19, 1861. He was educated at Clifton and Oxford. In 1885 he joined the 7th Hussars, participated in the Nile expedition, 1899, and in the Boer War, 1899-1902, in which he was cited for bravery. In 1909 he was sent to India as chief of staff, and at the beginning of the World War he commanded Aldershot. With Field-Marshal French he led the first British expeditionary force to France, succeeding French in 1915 as commander-in-chief of British forces in France and Flanders. In 1917, when French morale was at a low ebb, Haig bolstered the Allied spirit with the fierce offensives of Messine and Passchendaele. He stubbornly resisted the German drive early in 1918, in which they used 44 divisions in an effort to break through to the Channel ports. "There must be no retirement," he said to his troops. "With our backs to the wall . . . each one of us must fight to the end." In cooperation with Marshal Foch he launched successive offensives against the Germans after their advance was finally checked in July, sweeping them back into Belgium. On Sept. 27, 1918, Haig launched his wedge against the Hindenburg line, west of St. Quentin, with the Belgian and French on his left, and the Americans and French on his right. The war ended 45 days later. In recognition of his services, Haig was raised to the peerage in 1919. He died at London, Jan. 29, 1928.

HAIL, a precipitation of water in solid form, appearing as frozen raindrops, but intermediate in hardness and solidity between snow and ice. They may be either single drops, around one-eighth of an inch in size, or conglomerations of a large number of drops, in which case they may grow to 3 or 4 inches in diameter. Hailstones larger than half an inch are of infrequent occurrence, however.

As to the formation of hail, it is believed that there are roughly speaking three layers in the atmosphere where water vapor condenses. In the lowest of these, ordinary rain results; in the middle one, which is slightly colder, the small hailstones originate; while the upper one is the birthplace of snow. It appears probable, furthermore, that the larger hailstones, originally formed in the intermediate layer, may be carried up further by comparatively warm currents of air into the snow region, and there acquire a coating of snow crystals. They then drop to the hail region where a coating of ice is deposited. After several repetitions of this they become so heavy that no air current can support them, and fall to earth. Examination of these larger stones has shown that they consist of alternate shells of snowy ice, and solid ice, thus bearing out the above theory.

Hailstorms often occur previous to a thunderstorm, and as such they are more frequent in spring and summer than in winter. Owing to their hardness, weight and speed, hailstones may cause heavy damage to vegetation by their mere impact, but rarely fall in a quantity sufficient to cover the ground. Exceedingly small hailstones are often called SLEET. When they are soft and flimsily built, flattening out with a splash upon striking anything, they are known as soft hail.

HAINISCH, MICHAEL (1858-), Austrian statesman, was born in Aue, Austria, Aug. 15, 1858, the son of a manufacturer. His mother had been an early advocate of woman's rights, and Hainisch followed her in interesting himself in social questions, particularly in labor problems. In conjunction with Engelbert Permerstorfer he organized the Society of the Fabians, after the British model. To further the education of the masses, he established and endowed hundreds of "peoples libraries." In Dec. 1920 he was elected first President of the Austrian Republic and was reelected in 1924.

HAIPHONG, a seaport of Tonking, French-Indo-China, situated on the lower Song-koi or Red River delta about 20 mi. from the Gulf of Tonking. The bulk of the foreign trade of Indo-China passes through Haiphong, which like SAIGON is served regularly by several lines of ocean-going ships; over 1,000 vessels (1,340,000 tons) entered and were cleared in a year. The chief industries are cotton-spinning and the manufacture of soap and cement. Pop. 202,725.

HAIR, the fibers that grow out of the skin of mammals, covering the body in whole or part. The term, hair, is more correctly applied to straight or nearly straight fibers of moderate coarseness. If the coat of an animal is fine and thick, it is termed FUR; and if fine and also curled or matted, the designation, WOOL, is commonly used. Very coarse straight hairs are called Bristles.

Certain types of hair have distinctive names, e.g., mohair which is the long lustrous fleece of Angora goats, and alpaca which is the valuable hair of an animal of the same name. In addition to its natural function of protecting the living body, hair has many commercial and industrial uses.

Hair obtained as a by-product of the slaughter of cattle is an excellent filler for cushions, pillows and mattresses, because of its permanent softness and

resiliency. Hog hair, which is coarser and shorter, is used for stuffing upholstery, as an insulating material, as a binder for plaster, and for a wide range of other uses. Mohair is utilized in making garments, notably summer suits, and also for fine upholstery, and covering the seats of automobiles and railroad coaches. The uses of hair from different animals are, to a considerable extent, interchangeable depending on available supplies and price. Large quantities of hair from miscellaneous sources are used for the manufacture of brushes, wigs, toys, and sundry other purposes. D. S. B.

HAIR PREPARATIONS. Hair preparations include a wide variety of remedies for the treatment of hair and scalp disorders: pomades, brilliantines, and fixers for improving the appearance of the hair; hair restorers and dyes; and shampoos. Since the general health of hair and scalp so closely reacts upon their appearance, the practice of treating scalp disorders is frequently placed in the hands of the hair dresser or barber rather than of a physician or dermatologist. Extravagant claims are frequently made not only for the remedies, but also for preparations that are intended solely to beautify. Hair dyes have long labored under ill repute, due, partly to the use of poisonous ingredients and partly to the fact that they are indiscriminately recommended, although certain ingredients, harmless to some people, are harmful to others. Preparations to prevent, allay, and cure baldness are in great demand. However, no remedy has ever been discovered that is unfailing.

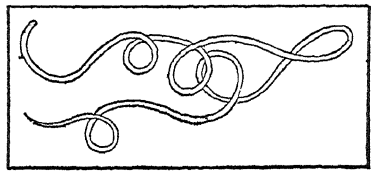
Hair dyes are presumably used to restore (hence the term) the original color of the hair, or to change the hair from one color to another. The industry of hair dyes runs into millions of dollars every year. These dyes depend for their coloring upon certain basic substances, such as silver salts, bismuth dyes, vegetable dyes, of which henna is the most important; the organic chemical dyes of which paraphenylenediamine (coal tar) is outstanding. This last is considered dangerous, as it is possible to absorb the chemical through the tissues, which may result in various local, organic and functional disorders. Peroxide of hydrogen used with ammonia may be included in this group, although its action is actually that of a bleach.

Shampoos are either solid or liquid. Liquids are by far the most popular and are considered superior chiefly because more easily washed from the hair. Soft soap, tincture of green soap, emulsified cocoanut oil, pine tar, are all used to make various types of liquid shampoos. The relative merits of these types, as in the case of all cosmetics, depend on the suitability of the basic ingredient to the individual, provided, of course, that the quality of the products and the expertness of manufacture are of high standards.

Brilliantines and pomades are hair dressings whose chief function is to give a pleasing gloss and a pleasant odor. Since the loss of luster is usually accompanied by other hair and scalp disorders, the use of brilliantines and pomades have diminished in favor of correctives.

Hair fixers are used for keeping the hair in a desired position, which in recent years have become increasingly popular to "set waves" into the hair, and for "finger waves" used in beauty parlors. These preparations are usually made of gum tragacanth and mucilage. G. R. F.

HAIRWORM, the popular name for a class (*Nematomorpha* or *Gordiacea*) of unsegmented worms, all of which are extremely small in diameter.



HAIRWORM
Gordius sp.

They may be from a few inches to three feet in length. As adults they live in the water where the eggs are laid. Shortly after they are hatched the larval hairworms seek some host, such as a bathing grasshopper or cricket, or the aquatic larvæ of a mayfly, into whose body they make their way by means of a special boring organ.

Sometimes the hairworm reaches adulthood within the body of the first host. But if the first host should be eaten by an appropriate second host, such as a beetle, the hairworm will continue its development within the second host. When the worm is mature it makes its way out of the host when the latter is in or near the water.

HAISLA, a dialect of KWAKIUTL, one of the major groups of the North American Indian Wakashan linguistic stock. The Haisla dialect is itself subdivided into Kitamat (Haisla proper) and Kitlope.

HAITI, a republic of the West Indies, comprising the western third of the island of Haiti or Santo Domingo; the remaining portion forms the Dominican Republic. The boundary separating Haiti and the Dominican Republic is about 193 mi. long. The island lies between Cuba on the west and Porto Rico on the east; to the north is the Atlantic Ocean, south the Caribbean Sea. Area is approximately 10,204 sq. mi. Port-au-Prince, est. pop. 1930, 150,000, is the capital. Cap Haitien had an estimated population in 1930 of 15,000, and Aux Cayes of 20,000.

Haiti is limited west and east by the Windward and Mona passages, and roughly presents the outlines of a swimming frog, with its head turned towards Porto Rico and its hind legs trailing westwards. It is a mountainous region, where the steep escarpments approach almost everywhere close to the surrounding waters, and leave here and there only a few strips of beach or terraced reefs leading to the rugged uplands of the interior. There are three distinct ranges of mountains, all extending east and west. The scenery is beautiful in places, and large and fertile valleys occur between the ranges.

Haiti is wholly in the tropics, but owing to the

great diversity of its relief it presents a wider range of climatic conditions than any other part of the Antilles. During the rainy summer months, Apr. to Oct., oppressive heat prevails at Port-au-Prince. Even in the dry winter season the normal temperature ranges from 70° to 80° F. on the lowlands, while the slopes from 1,500 ft. upwards enjoy a temperate and remarkably equable climate. Although the yearly rainfall is abundant, averaging 100 in., it is so irregularly distributed that some districts are almost comprised within the rainless zone and must resort to irrigation. The island is subject to disastrous hurricanes.

In the woodlands is an immense store of valuable trees, such as rosewood, mahogany, satinwood, pines, cedars, oaks and ironwood. All tropical fruits arrive at perfection; the coffee shrub has almost run wild; and no other region is better suited for tobacco and sugar culture. Coffee is the most important crop, and 75% of the production is exported. The raising of sugar, tobacco, sisal, logwood, cotton, cattle, fruits and nuts is important, but national prosperity depends on the coffee crop.

The inhabitants, who were estimated to number 3,000,000 in 1930, are nearly all Negroes or Mulattoes, the latter descendants of the former French settlers, and have the reputation of being peaceful and law abiding, and distinguished for their courtesy and hospitality.

The government is modeled on that of France, with a House of Representatives of 36 members elected by the people and a Senate of 15 members also elected by the people.

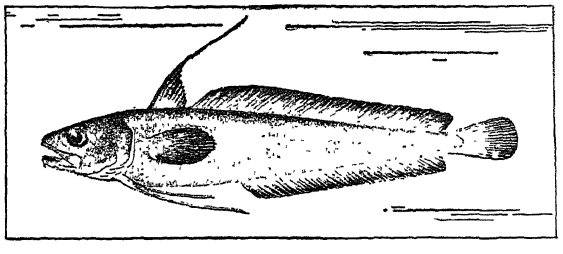
History. CHRISTOPHER COLUMBUS landed at Mole St. Nicholas, Dec. 6, 1492. The Spanish occupation of Haiti, begun in 1493, was attended by the oppression and rapid decline of the aborigines. The development of the island lapsed after the colonization of the continental mainland. In the 17th century French and English buccaneers established themselves at Tortuga, and made free use of the Haitian harbors. French adventurers established themselves on the western end of the island. In 1664 Louis XIV placed that district under control of the French West India Co., with Bertrand d'Ogeron as governor. D'Ogeron encouraged agriculture, had prospective wives transported from France, and supervised the founding of Cap Haïtien and other settlements. In 1697 Spain acknowledged France's title to the region. Saint-Domingue, as it was called, then received a definite colonial organization corresponding to that of New France. Port-au-Prince, founded in 1749, became the provincial capital in 1770. The production of indigo and sugar, and later of coffee, cotton, manioc and coconuts was the foundation of a remarkable economic prosperity. The increase in Negro slaves accompanying this agricultural development, however, assumed ominous proportions, particularly as the arrogant, corrupt social superstructure of whites disregarded the human feelings of the mulatto freedmen and the enslaved Negroes. A Negro insurrection in 1791 was successful, largely because of the ability of Toussaint L'Ouverture.

After a punitive expedition dispatched by Napoleon had retired, the revolutionary leaders, on Jan. 1, 1804, proclaimed an independent state under the aboriginal name of Haiti, with Jacques Dessalines as its first president. After a turbulent era in which for a time two principalities nominally existed, one a republican dictatorship under Alexandre Petion and Jean Pierre Boyer successively, the other a kingdom under HENRY CHRISTOPHE, and revolutions and civil wars were frequent (*see also* DOMINICAN REPUBLIC), the miserable state of public finances invited the intervention of foreign creditor nations. The military occupation of Haiti by United States marines began on July 25, 1915. A financial and political protectorate, enforced by the continued presence of marines, was arranged by treaty to extend to 1936. Meanwhile, in accordance with the report of the Forbes Commission in 1930, American occupation and control were reduced.

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HAJJ and **HAJJI,** terms used to refer to the Moslem great pilgrimage and the Moslem pilgrim, respectively. The hajji makes the hajj to the tomb of Mohammed in Medina and the sacred Ka'ba in Mecca. The pilgrimage to Mecca was enjoined by Mohammed himself upon every "believer" at least once, if he were free to go and could afford the journey. The hajj is an occasion of elaborate ceremonial, performed during the 12th month of the Moslem lunar year, and is of great effect upon the Moslem world community.

HAKE, THOMAS GORDON (1809-1895), English poet, was born at Leeds, Mar. 10, 1809. He studied medicine and practiced in East Anglia and London, where he became the physician and close friend of DANTE GABRIEL ROSSETTI. His poetry, distinguished for its originality and symbolism, appeared in the collections *Poetic Lucubrations, Parables and Tales, New Symbols* and *The Serpent Play, A Divine Pastoral.* Hake died in London, Jan. 11, 1895.



SQUIRREL HAKE

HAKE, the name for a family (*Merluciidae*) of large, voracious, marine fishes allied to the codfishes. The silver hake (*Merluccius bilinearis*), common off the coast of New England, is a fair food fish when eaten fresh. The closely allied Pacific hake (*M. pro-*

ductus) occurs on the Californian coast. In New England the name is applied to various fishes of the cod family, especially to the white hake (*Urophycis tenuis*), and the squirrel hake (*U. chuss*), both large bottom-feeding fishes valued to some extent for food and for their air bladders which are used for making isinglass and glue. In 1929 the total catch of hake in United States waters was 27,153,000 lbs., valued at $619,000. *See also* COD; ANGLING.

HAKLUYT, RICHARD (c. 1553-1616), English geographer, born near London about 1553. He attended Christ Church, Oxford, from 1570 to 1577 and, after completing his studies, began lecturing there. He published, in 1582, *Divers Voyages Touching The Discovery of America* which earned him recognition and an appointment with the British Ambassador at Paris. He returned in 1588, and in the following year published his principal work, *The Principal Navigations, Voiages, Traffiques and Discoveries of the English Nation.* Hakluyt wrote a considerable mass of geographic material, much of which was long, and some of which is still unpublished. He died in London, Nov. 23, 1616, and was buried in Westminster Abbey.

HAKODATE, a frontier city acting as the door to Hokkaido, the northern island of Japan. It extends along nearly 4 mi. of the curving shore of the island. The city is foreignized with such modern institutions as telegraph offices, a meteorological museum and a marine museum. The large import and export trade is concerned chiefly with fish, particularly salmon. Every summer, according to consular reports, more than 500 ships leave for the North Seas, returning with catches used for Russian caviar and other fish products. Pop. 1930, 197,252.

HALACHA is derived from a Hebrew verb *Halach* which means "to go." Hence Halacha signifies guidance as to the way of life. Specifically it refers to definite and succinct statement of a law, free from discussion and argument. In the widest sense it means the religious law of the Jewish people, including the broad legislation of the Pentateuch, the Written Law, and its detailed exposition, elaboration, amplification and development in the Oral Law. These two main divisions roughly correspond to the two branches of law familiar in the Occident as statute and common law.

Halacha covers every department of life, both of the individual Jew and of the Jewish community. Like every living organism, Halacha has grown and developed and takes account of changing conditions and circumstances. But the growth and development have been of an evolutionary, not a revolutionary, character. They have not involved sudden or violent breaks with the past.

Halacha, in the sense of decisions on specific points as they arose, are already to be found in the Scriptures. (Exodus 16:22; Leviticus 10:16-20; Joshua 9:20.) There are traces of Halacha in this sense in the other books of the Bible. But the development of Halacha begins after the return from the Babylonian Exile and was carried on during the entire period of the Second Temple by the Pharisaic leaders. The first period was that of the Scribes, the second the earlier and later *Tannaim,* or teachers of the Law, of whom the outstanding figures in successive generations were Ezra the Scribe, Simon the Just in the days of Alexander the Great, Hillel of the golden rule, "What to thee is hateful do not do to another," who lived in the days of Herod. Till the days of Hillel the Halacha was determined in case of differences of opinion by the majority vote of the Synhedrion.

Afterwards two schools came into existence. The lenient school was known as the School of Hillel; the rigorous and severe school was that of Shammai. Among the Roman Jurisconsults there was also a similar line of division between Capito and Labeo and their followers, as well as between the Proculians and Sabinians.

The Halacha was transmitted by word of mouth from one generation to another. Rules of interpretation of the Scriptures were formed by Hillel and by other great teachers. There were many collections of Halacha in use in different schools, till the days of R. Judah the Prince (140-220 A.D.). He compiled the Mishna which is the first Jewish Code, the first systematic arrangement of traditional law in which the dicta are sometimes given anonymously but more frequently prefixed with the names of the authors. With very few exceptions it is nearly all Halacha, setting forth in short sententious dicta the practice of Judaism. The halachic discussions are continued in the Gemara, which is a voluminous commentary on the Mishna, and is available in two recensions, the Palestinian, compiled in the 4th century, and the Babylonian in the 6th century. The authorities cited in the Gemara are called *Amoraim,* or speakers, who were succeeded by the Saboraim, or expounders. The traditions thus established were subsequently continued by the Geonim, or Excellencies. They were the heads of Sura and Pumbeditha, the chief Jewish schools in Babylonia. Questions were referred to them for decision. Their answers, known as the Responsa of the Geonim, were collected and enjoyed authority. Some of the Geonim compiled manuals dealing with portions of the Halacha. Later on summaries of the Talmud were written. The most famous is the Alfasi by Isaac of Fez. This work deals only with law that is still practiced and not with obsolete laws. The next great code after the Mishna was composed by Maimonides (Moses ben Maimon, 1135-1205) who was court physician in Cairo to Saladin. This code, in 14 parts, called *Mishna Torah,* or Repetition of the Law, covers the entire domain of Jewish law, theology, cosmogony and ethics. But the most notable summary of the halachic discussions in the Talmud is that of R. Asher ben Jehiel. His son R. Jacob ben Asher wrote the *Arba'Turim,* "the four Rows" (title taken from Exodus 28:17). The first deals with the rules of daily life throughout the year, personal cleanliness, worship, place of worship, Sabbaths, festivals. The

others treat respectively of matrimonial relations; questions referred to a religious authority, e.g., dietary laws; civil jurisprudence. The sources besides the Talmud on whom the compiler relies for his decisions on disputed points are his father's Summary, Maimonides's Code, and Alfasi's Summary.

Joseph Caro wrote an extensive Commentary, completed in 1542, tracing the sources of this work. Moses Isserles of Cracow made short notes on it. The former then wrote a manual, known as the *Shulchan Aruch,* or The Table Prepared, following the chapters of the *Turim.* That work was completed by Caro in 1551. Moses Isserles wrote notes on this manual, giving the practice of the German Jews. Commentaries on these works are exceedingly numerous. Responses dealing with new cases as they arise have been and are being written.

And so Halacha is a living system broadening out from precedent to precedent up to the present day.

M. Hy.

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HALBERSTADT, now a city in the Prussian Province of Saxony, about 28 mi. southwest of Magdeburg. It was formerly capital of the extensive ecclesiastical principality of the same name. The bishopric was founded at the beginning of the 9th century and came to an end in 1648. The architecture is medieval, with the upper stories of the houses projecting one beyond the other, and with interesting carvings. The old ratskellar and the ratswage are interesting. The cathedral is noteworthy for its architecture and it has a large collection of relics and works of art. Near the entrance is the "Devil's Stone," probably a pagan altar. There are nine other noteworthy churches as well as the former residence of the bishops. In the Heineanum Museum is one of the largest collections of birds in Germany (13,700 specimens). There are extensive manufactures, particularly leather gloves, machinery, sugar and cigars. Pop. 1925, 48,125.

HALDANE, RICHARD BURDON, VISCOUNT (1856-1928), English statesman, was born in Cloanden, Perthshire, on July 30, 1856. He was educated at the universities of Edinburgh and Göttingen, and was called to the bar in 1879. He entered Parliament as a liberal in 1885, and served there until 1910. As secretary for war in Campbell-Bannerman's cabinet, he reorganized the British army. He was raised to the peerage in 1911, and became lord-chancellor in 1912. In the same year he went to Germany to sound out the Kaiser and his government on the possibility of an Anglo-German understanding on naval armaments and other matters, but nothing came of the mission. Perhaps this and his intimate contact with German intellectual life and interests were reasons for the accusation that he was pro-German. He retired from public life to the further study of philosophy, and published several profound works. In 1924 he served as lord chancellor in the Labor cabinet under MacDonald. He was an ardent champion of the growth of universities, arguing that England was far behind other European nations. Accordingly, by a brilliant speech in the Commons, he put through the London University Act of 1898. He was also interested in developing the University of Dublin, and in 1903 he aided in granting charters to many new British universities. He died at Cloan on Aug. 19, 1928.

HALDEN, a city of Norway in the district of Ostfold at the confluence of the Tistedalselv and the Ide Fjord and on the railway between Oslo and Gothenborg. It is surrounded by crags and since the fire of 1826, has been rebuilt with regular streets and more permanent edifices. The town has a good harbor and engages in shipping and the lumber trade. It was called Halden until 1665 and was held against the Swedes in 1658-60. Under Frederik II its name was changed to Fredrikshald but in 1928 it was again named Halden. The rocky fortress Frederiksten, erected after 1661 under Frederik III, was unsuccessfully besieged in 1716 and 1718 by Charles XII, who met his death there. In 1814-15 the city was in the hands of the Swedes. The Convention of Karlstadt, 1905, provided for the removal of the fortifications built in 1902. Pop. 1930, 10,337.

HALE, EDWARD EVERETT. (1822-1909), American writer and preacher, was born at Boston, Mass., Apr. 3, 1822. He graduated from Harvard, studied theology and held pastorates in Worcester and Boston. His fame rests, however, upon his many writings, and also upon his work for practical Christianity and social reforms. His story, *A Man Without a Country,* has become a classic, and his *Ten Times One Is Ten,* originated the "Lend-a-Hand" societies. Among other works are *A New England Boyhood* and *Memories of a Hundred Years.* Hale died at Roxbury, Mass., June 10, 1909.

HALE, GEORGE ELLERY (1868-), American astronomer, was born at Chicago, Ill., June 29, 1868. He studied at the Massachusetts Institute of Technology, Harvard Observatory, and in Berlin. He founded the Kenwood Observatory near Chicago in 1889, and from 1895 to 1904 was director of the Yerkes Observatory of the University of Chicago, whose faculty he had joined in 1892. In 1905 he organized and became director of the Mt. Wilson Observatory, at Pasadena, Calif., from which position he retired in 1923, to become honorary director. In 1927 he again founded a private heliophysical observatory in Pasadena. He is chiefly known through his invention of the spectroheliograph and spectrohelioscope, and for his successful organization of national and international relations in science by means of such societies as the Solar Union, the International Astronomical Union, and the National Research Council.

HALE, JOHN PARKER (1806-73), American statesman, was born in Rochester, N.H., Mar. 31, 1806. He studied law, and practiced in New Hamp-

shire, where he served two years in the Legislature. Appointed U.S. District Attorney in 1834 he held this post for seven years. From 1843-45 he was a Democratic member of Congress. His stand against slavery lost him the support of his party, and he was not reelected. In 1847 he was elected to the Senate. In the same year he was nominated for President by the Liberty Party, but in 1848 he refused to run, supporting Van Buren. In 1852 he was nominated by the Free Soil Party for President, polling 150,000 votes in the election. In 1854 he helped to organize the Republican Party and in the following year was again elected to the Senate where he joined Seward and Sumner in the denunciation of slavery. From 1865-69 he was Minister to Spain. He died at Dover, N.H., Dec. 19, 1873.

HALE, SIR MATTHEW (1609-76), English jurist, was born Nov. 1, 1609, at Alderley, Gloucestershire, England. In 1629 he entered Lincoln's Inn and in 1637 was called to the bar. He became judge in the Court of Common Pleas in 1653. Upon his restoration in 1660, Charles II named Hale baron of the Exchequer, and later the same year he was appointed lord chief justice. He died at Alderley, Dec. 25, 1676.

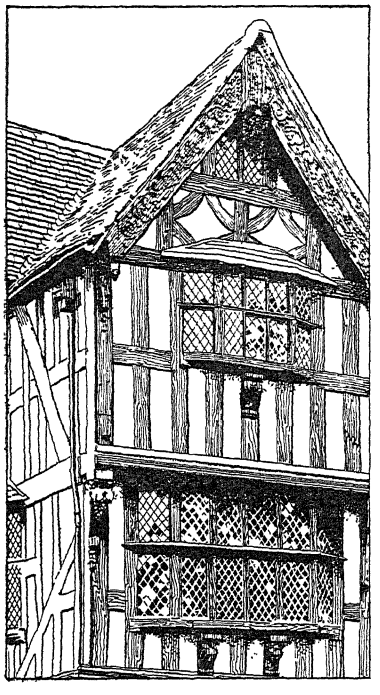
HALE, NATHAN (1755-76), American patriot, was born at Coventry, Conn., on June 6, 1755. Graduating from Yale College with high honors in 1773, he became a teacher. On the outbreak of the Revolution he enlisted in the army, and in 1776 was commissioned a captain. In September of that year he volunteered to obtain needed information within the enemy's lines, and, disguised as a Dutch schoolmaster, succeeded in his object; but he was captured by the British before he could return, and was condemned and hanged as a spy. His last words, "I only regret that I have but one life to lose for my country," have never been forgotten. His execution took place in New York City, Sept. 22, 1776.

HALE, SARAH JOSEPHA BUELL (1788-1879), American author, was born at Newport, N.H., Oct. 24, 1788. Left a widow with five small children, she began writing, and in 1827 published a novel, *Northwood.* She edited the first woman's magazine in America, originally *The Ladies' Magazine,* and later *Godey's Lady's Book.* She wrote voluminously, but her principal work is *The Woman's Record,* consisting of biographies of famous women. Mrs. Hale's welfare work was of enduring value. She established in Boston the parent Seaman's Aid Society, raised money for the completion of Bunker Hill Monument, and helped to bring about national observance of Thanksgiving Day. She died at Philadelphia, Pa., Apr. 30, 1879.

HALEVI, JUDAH. *See* JUDAH HALEVI.

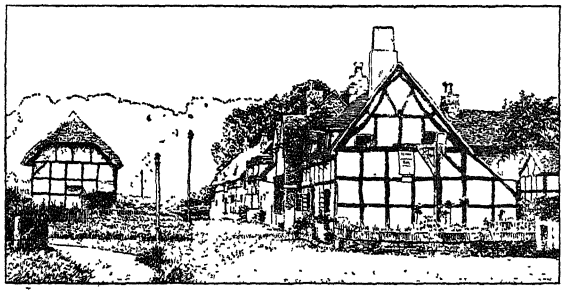
HALÉVY, JACQUES-FRANÇOIS (1799-1862), French opera composer, was born at Paris, May 27, 1799, of Jewish parents. A Conservatoire student, he won the Prix de Rome in 1816. His best known of a dozen operas is *La Juive,* produced in 1835. He died at Nice, Mar. 17, 1862.

HALÉVY, LUDOVIC (1834-1908), French dramatic author and novelist, was born at Paris, Jan. 1, 1834. At an early age he began to write for the stage, and in collaboration with Henri Meilhac was the author of a series of successful operettas, for which



TUDOR HALF-TIMBER WORK
Hall of the Butchers' Guild at Hereford England

JACQUES OFFENBACH wrote the music. *Orphée aux enfers, La belle Hélène, La Grande Duchesse de Gerolstein* and *La Perichole* all attained popularity. Later the collaborators turned from operetta to comedy, their best piece being *Frou-Frou.* Halévy also wrote the

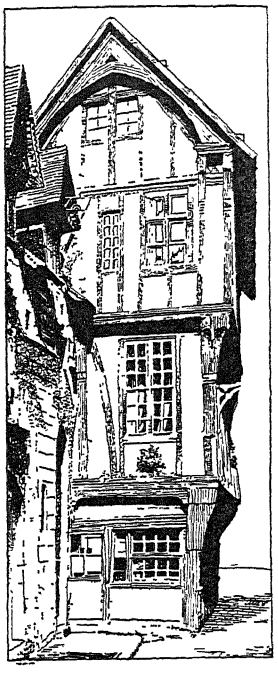


TUDOR HALF-TIMBER WORK IN AN ENGLISH VILLAGE
Shottery, in Warwickshire, where Anne Hathaway lived

well-known novel, *L'Abbé Constantin,* 1882, which won him a seat in the French Academy. He died at Paris, May 8, 1908.

HALF-TIMBER WORK, a method of construction in which all the main structural elements, such as posts, beams and braces, are of timber, with walls formed of brick, cement, plaster or stucco on lath, or withes filling the space between the timbers, but not

covering them over on the exterior. Half-timber is a system of construction developed independently in various parts of the world. It is found to-day in China and Japan as well as in Europe, and it was apparently common in pre-classic and classic times in Asia Minor and the Aegean area. Its most important development was that of France, Germany and England in the later Middle Ages, especially in the 15th century, when the decorative possibilities of the method were appreciated and highly developed. Although occasional half-timber churches were built, for example, St. Gilles at Cronceus, Troyes, late 14th century, the method was used especially for both town and city houses. In general French and German half-timber design is more purely structural than English, depending for its decorative effect upon simple uprights and horizontals, sometimes molded and carved, with a restrained use of diagonal, or occasional arched braces. English half-timber work in the earlier phases used many large upright posts close together. Later small curved braces were used to fill all the corners of small panels, and from this was developed a lavish use of purely decorative timber drops and little curved pieces forming cusped and foiled shapes.



FRENCH HALF-TIMBER CONSTRUCTION FROM AN OLD HOUSE IN ROUEN

Half-timber work was used until well into the early Renaissance throughout northwestern Europe, and in Germany its forms affected 17th century town houses even in stone. Characteristic examples of half-timber work can be seen in many towns in Normandy, the Rhine country, and central and western England, especially Rouen, Strassburg and Chester. Especially noteworthy are the Kammersellsches House in Strassburg, and Bramhall Hall, and Speke Hall, Cheshire, England, all of transitional early Renaissance date.

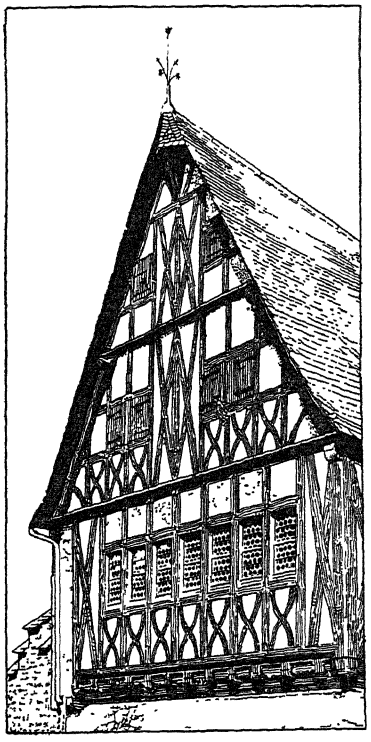
Many modern so-called half-timber houses are disastrously insincere imitations, the "timbers" being mere boards applied to the wall surface, and inexcusable from any critical attitude.

See Viollet-le-Duc, *Dictionnaire raisonné de l'architecture française*, 1852-1875, article Pan de bois; and Garner and Stratton, *Domestic Architecture of the Tudor Period in England*.

HALF-TONE. *See* PHOTOENGRAVING.

HALIBUT (*Hippoglossus hippoglossus*), the largest and most important of the FLATFISHES, highly valued for food. It occurs on shallow bottoms in all northern seas. The halibut lies on the bottom on its left side, which is blind and whitish; the upper or right side is dark brown in color and bears both eyes. The large mouth is armed with sharp curved teeth. Although full grown females average from 100 to 150 lbs. and males less than 50 lbs., some individuals attain a length of 9 ft. and weigh 700 lbs. The halibut is very voracious, feeding upon other fishes and also crabs and mollusks, and waiting on the bottom for its prey which it captures with a sudden rush, often rising to the surface.

The halibut has firm, white, non-oily, rather flavorless flesh and is usually eaten fresh. Young fish, known as chicken halibut, are valued for their delicacy. Though halibut was formerly caught in great quantities along the eastern coast of North America, its numbers there have greatly diminished. About 95% of the North American catch is now taken on the Pacific coast, mostly from Alaskan waters. In 1929 the total United States catch was 55,297,000 lbs., valued at $6,413,000; the Canadian catch amounted to 335,824 cwt., valued at $3,970,898. A. B. J.



GERMAN HALF-TIMBER CONSTRUCTION
From the Rathaus in Oberlahnstein

HALIDES, chemical compounds containing one of the HALOGENS, chlorine fluorine, bromine and iodine, and another element or radical. These compounds are termed CHLORIDES, FLUORIDES, BROMIDES, and IODIDES, respectively. The halogens combine with the pure metals and most of the simple non-metallic substances, their relative activity varying in gradations from fluorine, the most active, through chlorine, and bromine to iodine.

HALIFAX, CHARLES MONTAGUE, 1st Earl of (1661-1715), English statesman and financier, was born at Horton, Northamptonshire, Apr. 16, 1661, and after being educated at Trinity College, Cambridge, he soon distinguished himself in literature by composing a poem in 1685 on the death of Charles II. Two years later he collaborated with Matthew Prior on *The Town and Country Mouse.* In 1689 Montague was elected to the Convention Parliament and supported the claim of William III to the throne. He was appointed Commissioner of the Treasury in 1692, in which office he raised £1,000,000 by loan, the first British public debt. Montague later established a national bank which became the present Bank of England. In 1694 he was made Chancellor of the Exchequer, the following year undertook the recoinage of British money. He was created Earl Halifax in 1700. On the accession of George I in 1714, he was made First Lord of the Treasury. He remained in office until his death on May 19, 1715.

HALIFAX, GEORGE MONTAGU DUNK, 2d Earl of (1716-71), was born Oct. 5 or 6, 1716. He succeeded his father as earl in 1739. He was instrumental in founding Halifax, the capital of Nova Scotia and in promoting British trade with North America. Halifax was at one time president of the Board of Trade and held various military and government offices. He died June 8, 1771.

HALIFAX, a municipal and county borough in the West Riding of Yorkshire, England, 194 mi. northwest of London. The town grew up about a cloth trade, which starting in the 15th century, made it a wealthy clothing center by the 17th century. Daniel Defoe spent some time at Halifax when in political exile from London. A few ancient houses and the remains of two churches survive. The town hall, library and museum are fine modern structures. Today carpet weaving is of primary industrial importance, employing thousands, and the cotton, iron and steel machinery manufactures are extensive. Coal and firestone are native to the region. Pop. 1921, 99,183; 1931, 98,122.

HALIFAX, city and capital of Nova Scotia, Canada, the county seat of Halifax Co., situated on the southeast coast of the province. Lying upon a sloping, fortified hill above Halifax harbor, Halifax has since its foundation been one of the chief defenses of British North America. It is an important port with an ice-free harbor and extensive piers and dockyards accommodate the city's important marine traffic. Exports, among the largest in the Dominion, include fish, lumber, apples and other regional agricultural produce. Manufactures include iron, steel, textiles, furniture, rope and sugar. Substantially built, Halifax contains the provincial parliament buildings, citadel, and other public works, five parks and many schools and churches, among them several of the 18th century. Since 1921 an extensive building program including an airport and development of port facilities, has been in progress. It was from Halifax that the Cunard Co. in 1840 inaugurated the first regular transatlantic service. The city was founded by Hon. Edward Cornwallis in 1749 on Chebucto Bay. It participated in the War of 1812, and during the United States Civil War was a favored base of Confederate blockade runners. In 1917, the explosion of a Norwegian steamer with Belgian relief supplies severely damaged the city. Halifax was incorporated in 1842. Pop. 1921, 58,372; 1931, 59,275.

HALIFAX FISHERIES COMMISSION, 1877. The joint high commission of 1871 (*see* WASHINGTON, TREATY OF) provided that the United States should have the right to take fish within the territorial waters of the Gulf of St. Lawrence for a 12-year period, and that a tribunal to consist of one member appointed by the United States, one by Great Britain, and one representing a disinterested third party, should decide the amount of compensation due Great Britain for this and other privileges of inshore fishing along the British North American coast. In 1875 E. H. Kellogg was appointed by President Grant and Sir Alexander Galt by Queen Victoria; the United States was forced to accept M. Delfosse, Belgian diplomat, as third commissioner. Intimate political and marital relations between England and Belgium indicated that the tribunal's award would be biased. The tribunal met at Halifax from June to Nov. 1877, taking testimony from fishermen and fish-dealers and hearing the arguments of counsel. An agreement setting the award to Great Britain at $5,500,000 in gold was signed by Galt and Delfosse; Kellogg refused to sign. Congress very nearly repudiated the agreement on the ground that a unanimous decision was necessary, but ultimately authorized a draft of the sum to the British treasury, with insistence that the sum was paid solely in order to maintain good faith in treaties and to encourage the principle of arbitration of international disputes.

HALITE, the mineralogical name for sodium chloride, or common SALT. When pure it is translucent white, or colorless and transparent, but is often tinted by impurities. Crystallizing in the ISOMETRIC SYSTEM, halite usually forms cubes which may have cavernous faces but which always exhibit perfect cubical CLEAVAGE. It is characterized by its taste. Salt occurs in sedimentary formations of all geological ages and in all parts of the world, the result of chemical precipitation in isolated bodies of water. Clay and sandstone series often contain considerable thicknesses, associated salts frequently being ANHYDRITE, GYPSUM and CALCITE. *See also* SEDIMENTATION; DEPOSITS; MINERAL DEPOSITS; MINERALOGY; CRYSTALLOGRAPHY.

HALL, ARNOLD BENNETT (1881-), American educator, was born in Franklin, Ind., July 22, 1881. He studied at Franklin College and at Chicago University. From 1910-26 he was a faculty member in the department of political science of Wisconsin University. In 1923 he founded the National Conference on the Science of Politics, and in 1926 left Wisconsin to become president of the University of Ore-

gon. His books include *Outline of International Law,* 1915; *The Monroe Doctrine,* 1919, and *Popular Government,* 1921.

HALL, ASAPH (1829-1907), American astronomer, was born at Goshen, Conn., Oct. 15, 1829. Beginning life as a carpenter he acquired an education in mathematics and astronomy by occasional school and university work and intensive individual study. From 1862 to 1891 he was astronomer of the Naval Observatory, Washington, D.C., making three expeditions to study eclipses. On Aug. 11 and 17, 1877, he discovered the two moons of Mars. From 1895 to 1901 he was professor of astronomy at Harvard University. Hall died at Annapolis, Md., Nov. 22, 1907.

HALL, CHARLES MARTIN (1863-1914), American inventor, was born Dec. 6, 1863, at Thompson, O., and studied at Oberlin College. In 1886 he invented an electrolytic process for the reduction of aluminum: two years later he perfected it sufficiently to produce aluminum in great volume. This turned a hitherto costly metal into a cheap commercial product. Hall began its extensive manufacture and became vice president of the Aluminum Company of America, which held the patent which secured the monopoly of production in the United States until 1912. The inventor was awarded the Perkin medal for work in chemistry, 1911. He died at Daytona, Fla., Dec. 27, 1914, leaving the greater part of his wealth to educational institutions, including Oberlin College.

HALL, GRANVILLE STANLEY (1844-1924), American educator and psychologist, was born at Ashfield, Mass., Feb. 1, 1844. After graduating from Williams College in 1867 he spent two years in Germany studying psychology and philosophy. In 1871 he graduated from Union Theological Seminary and preached for a short time. He gave this up in 1872 to become professor of psychology at Antioch College, where he remained for four years, and then returned to Germany to study under Wundt, Helmholtz and Fechner. While there Hall met Pres. Charles Eliot and at his request returned to Harvard to tutor in English. At the same time he took post graduate work at Harvard, studying under WILLIAM JAMES. From 1881-88 Hall was professor of psychology at Johns Hopkins University and established one of the earliest psychological laboratories in the United States. Among his students were men who have since achieved great eminence, Cattell, Sanford, Jastrow and Dewey.

Hall's work at Johns Hopkins led to his appointment as president of Clark University in 1888, and from about this time on his interest in educational methods paralleled his interest in psychology. He devoted much time to child study. In 1887 he founded *The American Journal of Psychology* and was its editor until 1921. He founded the American Psychological Association in 1892. Hall died at Worcester, Mass., Apr. 24, 1924.

Among his writings are *Adolescence,* 1904; *Youth: Its Education, Regimen and Hygiene,* 1907; *Morale: The Supreme Standard of Life and Conduct,* 1920; and *The Life and Confessions of a Psychologist,* 1923.

M. R.

See L. Pruett, *G. Stanley Hall; a Biography of Mind,* 1926; L. N. Wilson, *G. Stanley Hall, A Sketch,* 1914.

HALL, JOSEPH (1574-1656), English bishop and writer, was born at Bristow Park, Ashby-de-la-Zouche, Leicestershire, July 1, 1574. He was educated at Cambridge, and entered the church, becoming successively Dean of Worcester, Bishop of Exeter, and Bishop of Norwich. In 1641 he and several other bishops, having protested against certain laws, had their property confiscated and were imprisoned in the Tower for several months. Hall retired to a farm at Higham, near Norwich. He was one of the ablest satirists of his time, and attacked the affectations of contemporary literature. His principal work was the *Virgidemiarum,* in six books. He died at Higham, Sept. 8, 1656.

HALL, originally the large central room of an English medieval house, which served alike as a meal room, a residence for retainers, and a living-room. Later, through the development of additional privacy and more complex plans, the hall became first a monumental central chamber, and later a mere vestibule or means of entering other rooms; hence, the modern use of the word as synonymous with corridor or passage. The original significance explains the English use of the word as the name of a house, especially a manor house, as Bracebridge Hall; the use of the word to express any large and monumental room, and for the great dining-halls of colleges or similar organizations, such as the Inns of Court, etc.

The earliest residences of the feudal lords in England, as in much of northern Europe, seem to have consisted of an enclosure surrounding several separate huts or structures. The largest of these was the hall, which was similar in use and often in form to the Roman ATRIUM. By the 13th century the form had become generally standardized. The hall was a large room of the full height of the building with an open timber roof. In the center was a hearth and over it a hole in the roof, usually protected by a lantern or cupola, for the escape of the smoke. The entrance was at one end, and led into a vestibule behind a screen and under a gallery, the musicians' gallery, that extended all across the width of the hall. At the other end was the Dais, or raised platform, which formed the dining- and living-room of the lord's family and private guests. In the body of the room were the long tables and benches where the retainers ate and sometimes slept. The service rooms, kitchen and store rooms, were at the entrance end of the hall and were entered from the passage behind the screen. The private living-rooms and the chapel were at the other end and entered from the dais. As glass became cheaper, the hall windows were made larger and larger, and a great glazed bay window was opened off the dais, as in the hall of Hampton Court Palace, early 15th century. Sometimes there were two, opposite each other. At the same time, wall fire-

places with chimneys replaced the original central hearth. T. F. H.

Consult J. A. Gotch, *Growth of the English House,* 1909.

HALLAM, HENRY (1777-1859), English historian, was born at Windsor, July 9, 1777. He attended Eton and Oxford, and later was active in literary work, contributing articles to the Edinburgh *Review,* and writing books as *Europe during the Middle Ages, The Constitutional History of England,* and *Introduction to the Literature of Europe in the 15th, 16th, and 17th centuries.* He was a member of the Whig party and advocated the abolition of slavery, working with WILBERFORCE. He died at Penshurst, Kent, Jan. 21, 1859.

HALLE, a German city in the province of Saxony, located on the Saale River about 21 mi. northwest of Leipzig. It is the second largest city in the province and is the seat of a university founded in 1694. Owing to its saline springs, it became a trading center very early, belonged to the archbishopric of Magdeburg from 968 to 1680, and since then has been Prussian. The principal products are machines, sugar and starch, and the trade is chiefly in grain, sugar and groceries. On the imposing market place is the Red Tower of 1506 and a statue of HANDEL, who was born in Halle in 1685. The rathaus was begun in the 14th century. Near by is the late-Gothic Market Church, or St. Mary's, erected in 1529-51. Behind it is the St. Moritz Church of the 14th and 15th centuries. The cathedral was dedicated in 1523; adjoining it is the former palace of the Magdeburg archbishops. The principal university building was erected 1834. The city was founded by Charlemagne in 806 as a frontier fortress. Pop. 1925, 194,575.

HALLECK, HENRY WAGER (1815-72), American general, was born in Westernville, N.Y. He graduated in 1839 at West Point. After serving in the Mexican War, he took a prominent part in organizing the State of California, and practiced law in San Francisco. With the advent of the Civil War he was commissioned a major-general. In 1862 was made Commander-in-chief of all the U.S. Armies, and directed their movements in the field until 1864, when he became chief of staff. During 1865-71 he commanded the military division of the Pacific. He died Jan. 9, 1872, at Louisville, Ky.

HALLER, ALBRECHT VON (1708-1777), Swiss anatomist and physiologist, was born in Berne on October 16, 1708. He studied medicine at Tübingen and at Leyden, graduating in 1727. In 1728 he began to practice medicine in Berne, and in 1736 was appointed to the chair of medicine, anatomy, surgery and botany in the newly established University of Gottingen, which position he held for seventeen years. While in this capacity, he published a monthly periodical to which it is said he contributed some 12,000 articles concerning every branch of knowledge. In 1753 he tendered his resignation to the University of Gottingen and returned to Berne. He then prepared his Bibliotheca Medica, three parts of which he lived to complete, and among other medical works he published his great contribution, *Elementa physiologiae Corporis humani.* He died December 17, 1777.

Haller, because of his unusual ability to grasp detail, was an excellent historian of medicine, ranking the best after Guy de Chauliac. Among his contributions to medicine may be named his reassertion of the mechanism of respiration and automatism of the heart, his admission of the use of bile in the digestion of fat, and the first experimental injections of putrid matter into the living body. Haller distinguished between nerve impulse (sensibility), and muscular contraction (irritability). M. F.

HALLEY, EDMUND (1656-1742), English astronomer was born at Haggerston, Oct. 29, 1656. After studying at Oxford he went to St. Helena to determine the position of certain southern stars. From 1693 to 1716 he developed his method of computing the solar parallax from the transit of Venus and in 1701 published the first large map of the magnetic variations calculated from the mass of the earth. Attacking the problems of lunar distances he developed that method no longer used, of finding longitude at sea. In 1705 he discovered that the comets of 1531, 1607 and 1682 were the same and predicted its return in 1759, this constituting the first satisfactory work on the orbits of comets. It now bears his name. For 22 years he was astronomer royal in charge of the Greenwich Observatory. He died at Greenwich, Jan. 14, 1742.

HALL-MARK, the legal mark stamped upon articles of gold or silver, after having been assayed, by the British Goldsmith's Company and the Government Assay Office. It includes the mark of the standard of quality, the assaying office's mark, the date mark, and the manufacturer's private mark. There are no official hall-marks in the United States.

HALL OF FAME, AMERICAN, a memorial to great Americans, erected in 1900 on New York University grounds at University Heights, New York City. The building, a gift of Helen Gould, is semicircular in form with a colonnade superimposed on a granite corridor which connects two of the buildings of the University. Within the colonnade are 150 panels provided for bronze tablets inscribed with the names and achievements of those chosen for membership. Above each panel is an open space for a bust or statue. The granite corridor constitutes a repository for various mementos.

Under the constitution of the Hall, those eligible to election must be native or naturalized citizens of the United States who are distinguished by notable achievements and who have been dead twenty-five years or more. The University invites nominations from the public and every nomination approved by 2 members of the University senate is submitted to an electorate of 100 eminent citizens who determine the names admitted. Elections are held every five years. The constitution provided that not more than 50 names should be chosen in 1900 and that five more might be added at every succeeding election until the year 2000 when the 150 panels would be filled.

In 1900: George Washington, Abraham Lincoln, Daniel Webster, Benjamin Franklin, Ulysses Simpson Grant, John Marshall, Thomas Jefferson, Ralph Waldo Emerson, Henry Wadsworth Longfellow, Robert Fulton, Washington Irving, Jonathan Edwards, Samuel F. B. Morse, David Glasgow Farragut, Henry Clay, Nathaniel Hawthorne, George Peabody, Robert E. Lee, Peter Cooper, Eli Whitney, John James Audubon, Horace Mann, Henry Ward Beecher, James Kent, Joseph Story, John Adams, William Ellery Channing, Gilbert Stuart.

In 1905: John Quincy Adams, James Russell Lowell, William Tecumseh Sherman, James Madison, John Greenleaf Whittier, Mary Lyon, Emma Willard, Maria Mitchell. In 1910: Harriet Beecher Stowe, William Cullen Bryant, Oliver Wendell Holmes, Frances Elizabeth Willard, Edgar Allan Poe, Andrew Jackson, James Fenimore Cooper, George Bancroft, Phillips Brooks, John Lothrop Motley. In 1915: Mark Hopkins, Daniel Boone, Francis Parkman, Charlotte Cushman, Elias Howe, Alexander Hamilton, Joseph Henry, Louis Agassiz, Rufus Choate. In 1920: Samuel Langhorne Clemens, Alice Freeman Palmer, James Buchanan Eads, Augustus Saint-Gaudens, Patrick Henry, Roger Williams, William T. G. Morton. In 1925: Edwin Booth, John Paul Jones. In 1930: James Abbott McNeill Whistler, James Monroe, Matthew Fontaine Maury, Walt Whitman.

Classified by achievements, there are 16 authors, 13 statesmen, 5 preachers, 4 inventors, 6 scientists, 4 jurists, 5 teachers, 5 soldiers and sailors, 2 philanthropists, 3 artists, 2 actors, 1 reformer, 1 pioneer, 1 engineer and 1 dentist.

HALLOWE'EN, the evening of October 31, when the vigil of All Hallows or All Saints is kept with merrymaking and jollity. In the old Celtic calendar October 31 was the last day of the year, a time when spirits and witches went abroad, and it is thought that the Christian Hallowe'en may be only a survival of the Druidical ceremony which took place then.

HALLUCINATIONS, the perceptual construction of an object without any sensory basis in fact. It has been customary to distinguish between hallucinations and illusions on the basis of sensory stimulation, which is involved in the latter but not present in the former. In the case of an illusion there has been a misinterpretation of actual sense data, whereas in an hallucination the objective stimulus is not present.

Hallucinations may be simple or compound, depending upon the number of senses involved. In the simple hallucination only one sense is affected, such as vision, hearing, or touch. The compound hallucination may involve several senses at the same time. Seeing a vision and hearing it scream almost simultaneously would be an example of the compound hallucination. Hallucinations vary from the harmless ones of sanity to the dangerous delusions of the insane. They may be provoked by drugs, such as opium or hashish, or be a product of hypnotic suggestion. Cases are known of individuals being able to produce hallucinatory states in themselves at will.

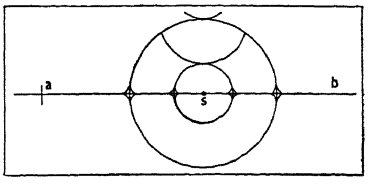
One of the most common forms of hallucination is the visual type. This consists of seeing objects not present to sense. Such objects are frequently known as apparitions. Visions of a bright light or the form of an individual furnish illustrations of this type. Next to the visual, auditory hallucinations are most common. The hearing of a voice or the sound of a bell are examples of this type. There may also be hallucinations of taste and smell; and kinesthetic hallucinations, in which the limbs feel as though they were turning to chunks of ice. The delusions of persecution experienced by the paranoic are often hallucinations of a dangerous type. The delusions of grandeur or of greatness are a most obnoxious kind of hallucination.

James had an interesting theory to account for the phenomena of hallucination. He thought they might be explained by the fact that nervous energy had become blocked and could not pass to its connecting centers, thereby producing an explosion. The phenomena have also been explained through cortical stimulation in the reverse order of perception. Hallucinations are undoubtedly a case of dissociation; but the manner in which the dissociation takes place is not accounted for.

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HALMAHEIRA, also Gilolo and Jilolo, an island of the Dutch East Indies forming part of the residency of Ternate. It is separated from Celebes by the Moluccas Passage and covers about 6,000 sq. mi. of mountainous and thickly wooded territory. The island produces coconuts, tropical fruits, sago and spices. Pearl fishing is an occupation of the natives. The chief town is Gilolo. Pop. about 100,000.

HALO, a luminous circle around the sun or moon. It may result from DIFFRACTION by small drops of water in the ATMOSPHERE, in which case it is small and close to the celestial body; or, it may be caused by the REFLECTION and REFRACTION by ice crystals floating in the air, in which case it is much larger.



HALO

S *represents the sun; small circle, 22° halo; large circle, 46° halo;* b, *parhelic circle;* a, *anthelion*

In the first case, the size of the circle is inversely proportional to the size of the drops, and it is colored, with the red outside. In the second case, it is independent of the size of the ice spicules. The latter condition is the more complicated, showing itself in various aspects, as follows: a colored circle surrounding the sun, red on the inside and white on the outside, of radius 22°, called the 22° halo; a similar, but larger, circle called the 46° halo. These are explained by the fact that ice crystals may be flat, disc-like hexa-

gons or elongated hexagonal prisms. If these crystals are oriented at random by laws of refraction, it can be shown that the 22° halo results from refraction by faces which form angles of 60° with each other, and the 46° halo from refraction by faces which form angles of 90°. In addition to these halos there may be seen: a horizontal, white circle, as *b,* (see figure) called the *parhelic circle;* concentrations of light on the parhelic circle, four colored ones where it intersects the halos, called *parhelia, sun dogs* or *mock suns,* and one white one at 180° from the sun, called the *anthelion;* and tangential contact arches. The latter are explained on the basis of definite orientation of the crystals, such as may occur in very still air. Those which are uncolored result from reflection and the others from refraction. The parhelic circle results from reflection at vertical, crystal surfaces.

P. I. W.

BIBLIOGRAPHY.—W. J. Humphrey, *Physics of the Air;* Wood, *Physical Optics.*

HALOGENS, a term applied to the chemical group comprising the elements FLUORINE CHLORINE, BROMINE and IODINE, so named because of the ease with which they form salts. These elements resemble one another in chemical properties and their physical properties show a definite gradation from fluorine, a gas, to iodine, a solid. The halogens combine directly with many of the other elements.

HALOPHYTES, in botany, plants which grow along seashores, salt lakes and in alkaline places where the soil or its waters contain a high percentage of salts. While most plants can absorb limited amounts of ordinary salt, practically all except the specially adapted natural halophytes will die if salt is present in abundance. The effect of salt is to restrict the plant's normal functions and particularly to prevent the absorption of water.

HALS, FRANS (c. 1581-1666), Dutch portrait painter, was born at Antwerp, probably in 1581, of Dutch parents temporarily residing there. He returned to Holland in his youth, where, at Haarlem, his father held various municipal positions. Hals studied with Van Mander, soon evolving his own individual and inimitable style. The Netherlands in the early 17th century was exceptionally rich in talented portrait painters. Of these only Rembrandt can be ranked with Hals, one of the greatest portrait painters of his own or any other period. His portraits have not Rembrandt's intensity nor his marvelous golden glow, but for vitality, a vivid impression of character and an exquisite silvery scheme of color, Hals can hold his own. The painter was of an unconventional temperament, leading a jovial and improvident life. Nevertheless he held many distinguished positions, including the presidency of the Painters' Guild of St. Luke. He brought up his 10 children creditably, and worked indefatigably until 1654, when misfortunes crowded upon him. The Haarlem Municipality aided him by grants, and gave him an annuity in 1664. Notwithstanding his troubles Hals continued to produce his magnificent series of portraits. The groups of officers of the Haarlem burgher guards, painted in 1616-39, are unsurpassed for harmony of color, strength and individuality. Equally so are the groups of Regents and Lady-Regents of the Haarlem Oudemannenhuis. The portrait of Hals with his second wife in the Amsterdam Gallery is of startling vitality, and the famous *Laughing Cavalier* of the Wallace Collection, London, radiates gaiety and delightful color. Later his shadows blackened and his tints became monotonous, though his portraits lost none of their pristine force and energy. Hals died at Haarlem, Aug. 24, 1666, and was buried there with pomp in the Groote Kerk. Among his pupils were Adrian Brouwer and Adriaen and Isaac van Ostade. His son, Frans Hals the younger (c. 1622-99), was a portrait painter of distinction.

HAM, one of the sons of Noah, according to the Book of Genesis, and father of Cush, Mizraim, Phut and Canaan. The descendants of these were the Ethiopians, the Mizraimites or the Egyptians, and the Canaanites. Etymologically *Ham* is derived from the Egyptian *chem* or *khem,* meaning black or Egypt. This Biblical genealogy accounts for our term Hamitic.

HAM, the hind leg of a hog, with the shank removed just above the hock joint. It is cured and smoked like bacon or used fresh for steaks and roasts.

Boiled ham is made by boning a cured ham, previously soaked to get rid of excess salt, removing skin and surplus fat, and tying the meat with cord to hold it together during cooking. It is simmered for several hours, cooled, and sometimes smoked lightly. California picnic hams are the shoulder with part of the butt cut off.

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HAMA, a city of Syria, located on the Orontes, about 180 mi. southeast of Tehran. Railways join Hama with Aleppo and Homs. The houses are low and mud-plastered, the streets narrow and unclean. In addition to the chief building, a castle belonging to the emirs of a local family, there are many small mosques. The city is the trading center of the Beduins of the region. Leather goods, woolens, cotton fabrics and silk sashes are the chief articles of commerce. Recently there has been keen competition offered by machine-made goods and Hama has suffered considerably on that account. Pop. 1929, 39,960.

HAMADAN, a city of Persia and capital of the Hamadan province located at the base of Mt. Alvand about 180 mi. southwest of Tehran. Though interspersed with gardens, the city is largely in ruins. In the middle of the city a domed structure of black wood is alleged to contain the tomb of Mordecai and Esther. Another edifice near a great mosque contains the tomb of the celebrated Arabian philosopher Avicenna, who died here in 1037. In ancient times the town was known as Ecbotana. Agha Mohammed Khan destroyed the town in 1789. Hamadan is the center of the leather industry of Persia. Carpet weav-

ing is also an important industry. Est. pop. 1930, 30,000.

HAMADRYADS or **HAMADRYADES,** in Greek mythology, the eight daughters of Hamadryas. Dryads and Oreads were the more usual names given to them.

HAMBORN. *See* Duissburg-Hamborn.

HAMBURG, capital of the German free state of the same name and the second largest city in Germany. It is situated on the Elbe River, 75 mi. above its mouth where the Elster empties into it. The center of the city is a semicircle resting on the river and bordered by parks occupying the place of the old fortifications and by the railroad station with its grounds. The old city is on the east and the new city on the west of the Alster. The old city with its numerous canals corresponds in its area to the medieval Hanseatic city and includes a still older city, the real nucleus of Hamburg. The city has grown beyond those borders only within the last century. Suburbs were incorporated, parts of the city rebuilt and, in the inner city, houses were demolished and new streets laid out. Thus, only a few buildings of the 17th and 18th centuries remain. The principal streets lead from the rathaus to the railroad station and through the new city to interior Alster. The latter is the center of Hamburg life, surrounded by the Alsterdamm, Alter and Neuer Jungfernstieg, with fine buildings, shops, hotels and the popular Alster Pavillion. The newer sections of the greater city extend in all directions north of the Elbe, surrounding the Alster and the canals. As elsewhere, the population of the inner city has diminished as the suburbs were built up.

Architecture. Hamburg's aspect is modern, as only the churches of St. Katherine and St. James are medieval. Trinity Church, 1743-47, and Great St. Michael's Church, 1740-52, are fine examples of Protestant churches. The secular buildings erected before 1800 are gabled houses with projecting upper stories. In later years, fine buildings for commercial houses rose in the city proper and some interesting skyscrapers covering large areas followed. A modern brick style has prevailed since the World War. Among the many monuments, the most noteworthy are those of Bismarck, William I, Heine, Lessing and Brahms.

Education. Including the University of Hamburg founded in 1918, nearly all the schools are of an eminently practical nature. English is included in the curriculum of the lowest schools, and all branches of industry and foreign and domestic trade are taught. There are large and comprehensive libraries, scientific and other societies.

Transportation. The tunnel under the Elbe for pedestrians and vehicles, consisting of two passages 1,476 ft. long, is the most important means of transportation from one bank to the other. Three large bridges from the port area to the city carry railroads, street railways, trucks and pedestrians. The street railways and buses radiate mostly from the rathaus to the environs.

Commerce. After great competition with Rotterdam and Antwerp, Hamburg regained its former position as third greatest seaport of the world, coming after New York and London. Its trade has extended uniformly to all parts of the world and its versatility in regard to various commodities is in great contrast to Bremen. Czechoslovakia has a special zone in the Hamburg harbor and, owing to the rivers and canals, its trade territory embraces Silesia and Poland also.

The harbor is on both sides of the Elbe and is a free port. Since 1929, the ports of Altona and Harburg-Wilhelmsburg belong to the Hamburg port territory.

Manufactures. Shipbuilding and allied works are the chief industries of Hamburg. There are also many factories which produce imported foodstuffs (as rice, coffee and cocoa), mineral oil, rubber, soap, wax, lacquer, dyestuffs, explosives, fertilizers and tanning materials.

History. Hamburg's origin is obscure, but about 811 Charles the Great erected a fortress there. A church soon followed, and in 831 an archbishopric was established for the propagation of Christianity in the north. The overlords were the counts of Holstein, who granted the city many privileges—the beginning of its independence. Hamburg soon joined the Hanseatic League and played an important part in the 13th and 14th centuries in the wars against the kings of Denmark and against the pirates. The discovery of America and the sea route to East India had a favorable influence on the trade. The Reformation was accepted 1529, but the city was spared in the Thirty Years' War by its powerful fortifications. It was, however, the direct trade with America beginning in the middle of the 18th century that gave Hamburg its prominence. It suffered greatly during the Napoleonic wars, but progressed steadily afterwards, despite a devastating fire in 1842. Hamburg's entrance into the German Customs Union in 1888 was an important factor in its growth. The extension of political rights in 1896 was followed ten years later by the introduction of a class system of suffrage for the general elections. In 1919, the constitutional assembly, in which the Social Democratic party had an absolute majority, was elected by both sexes under universal suffrage. A new constitution based on Democratic principles was adopted in 1921. Since 1924, a coalition of the Social Democrats, and German People's Party has been in power.

Population. In 1400, the number of inhabitants was estimated at about 10,000; in 1600, nearly 40,000; in 1811, 107,000; in 1880, 412,000; in 1913, 1,030,000; in 1925, 1,079,126. The area of Greater Hamburg embraced about 1,600,000 people in 1930.

HAMBURG, a village in Erie Co., western New York. It is situated 12 mi. south of Buffalo and is served by bus lines and the Erie Railroad. Vegetables, fruit, grain and poultry are raised in the vicinity. The principal local manufactures are optical glass, artificial flowers and automobile cushion springs. Pop. 1920, 3,185; 1930, 4,731.

HAMILCAR BARCA (c. 270-228 B.C.), Carthaginian general and statesman, father of HANNIBAL. Assuming command in Sicily towards the close, c. 247 B.C., of Carthage's first war against Rome, he chose Mt. Ercte as his base of operations. Rousing the mercenaries of Carthage to a high pitch of enthusiasm and loyalty he maintained Carthage's foothold in Sicily. When Rome by her naval victory at the Aegates Islands, in 241 B.C., forced Carthage to sue for peace, Hamilcar and his army were allowed to withdraw from Sicily without molestation. In 237 B.C. Hamilcar crushed a serious mercenary revolt in Africa. Between 236 and 228 B.C. he acquired by force and diplomacy much territory in Spain to compensate for the loss of Sicily and Sardinia. He seems to have contemplated renewed war with Rome. He fell in battle in 228 B.C.

HAMILTON, ALEXANDER (1757-1804), American statesman, soldier and lawyer, was born on the island of Nevis in the West Indies, Jan. 11, 1757. His father was Scotch, his mother of French descent. Deprived of parental care early in life, he worked in the store of Nicholas Cruger in St. Croix, at the age of 12, where he displayed unusual aptitude in mastering the details of the business. In 1772 he came to New York and soon after entered King's College (now Columbia), where he showed marked precocity. Revolt was in the air, and young Hamilton adopted the cause of the colonists. In 1774-75 he published two fiery pamphlets in their behalf which because of their outstanding quality were at first attributed to John Jay. When hostilities broke out, he became captain of the First Artillery Co. He won the notice of Washington and Greene in the campaign in the New York district in 1776, and in March 1777 was appointed to Washington's staff as lieutenant-colonel. For four years he was Washington's aide and confidential secretary, but resigned in February 1781, and obtained a field commission, later commanding a column which captured a British redoubt at Yorktown.

After the war, Hamilton practiced law in New York and rose rapidly to eminence in his profession. He served in Congress 1782-83 and in 1786 became a delegate to the Annapolis Convention, where with Madison he influenced the members to call the Philadelphia Convention of 1787. At this constitutional convention he advocated a strongly centralized government with absolute authority vested in a president and national congress. Although the document drafted by the Philadelphia Convention did not follow his ideas, he engaged in the campaign for its ratification, and was largely responsible for the favorable vote of the New York Convention. In 1787-88, with Madison and Jay, he published under the title of *The Federalist,* an important series of essays on governmental principles which profoundly influenced the shaping of the new nation.

Hamilton became Secretary of the Treasury in Washington's cabinet in 1789. In this post, the most trying of all, he demonstrated his genius as an organizer. His reports on the public credit, national banking, mints, manufacture, etc., were perfect models of their kind, and laid the foundations on which the financial system of the United States Government rests. His work was instrumental in reviving credit, both foreign and domestic, in stimulating business and in convincing the moneyed interests of the stability of the new government. Meanwhile, in the Cabinet, his conflict with Jefferson on the fundamental question of federal and state sovereignty grew ever sharper, leading eventually to the formation of the Federalist and Republican parties. In 1795 he resigned his cabinet position and resumed his private law practice in New York. After Washington's death he disputed the Federalist leadership with John Adams, and exercised greater influence over Adams's cabinet than did the President himself. Hamilton's active opposition to Aaron Burr brought about the latter's defeat in the New York gubernatorial election of 1804. A bitter personal and political enmity long existing between the two men culminated in a duel at Weehawken, N.J., which proved fatal for Hamilton. He died in New York the next day, July 12, 1804.

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HAMILTON, JAMES (1769-1831), English educator, was born near London in 1769. In 1814 he came to New York and began teaching languages, using a method of literal translation which he had learned in Hamburg. This effort won popular favor and he later founded Hamilton Institute at Baltimore. His principal textbooks were interlinear translations of the Gospel of St. John and Aesop's Fables into Greek, Latin, French, Italian and German. Hamilton returned to England in 1823, where he lectured and taught for many years. He died at Dublin, Oct. 31, 1831.

HAMILTON, SIR WILLIAM (1788-1856), Scottish philosopher, was born at Glasgow, Mar. 8, 1788. Educated at Glasgow and Oxford, he was admitted to the bar in 1813. Upon the death of Thomas Brown in 1820, Hamilton applied for the chair of moral philosophy at Edinburgh but failed to receive the appointment. The following year he taught civil history in this institution, and finally in 1835 he was appointed to the chair of logic. *The Philosophy of the Unconditioned* appeared in 1829, *Discussions on Philosophy and Literature* in 1852 and *Lectures on Metaphysics,* posthumously, in 1859. Hamilton held to the relativity of knowledge and the impossibility of knowing the unconditioned. Nevertheless he had a leaning toward a spiritualistic faith and exerted considerable influence in his day. He died May 6, 1856.

HAMILTON, a seaport and administrative center of the Bermudas, situated on Great Bermuda, Main or Hamilton Island. It has a deep landlocked harbor, reached through the narrow Two Rock Passage. The city was founded in 1790, during the

administration of Governor Henry Hamilton. It is a favorite resort for tourists, and contains some fine hotels, a cathedral, several churches, public parks and about 500 dwelling houses built of white coral limestone. Pop. 1931, 3,217.

HAMILTON, a city of Ontario, Canada, county seat of Wentworth Co., situated on Hamilton harbor, Burlington Bay, at the extreme western tip of Lake Ontario. A short canal intersecting Burlington beach affords entrance to Burlington Bay.

Hamilton is an important economic center for manufacturing, with hydroelectric power and light rates among the lowest on the American continent, and with excellent rail, highway and water transportation. Railways radiate from the city to all parts of the Dominion and connect with the New York Central, Lehigh Valley and Michigan Central railroads in the United States. There are steamship lines to Montreal, Fort William and Toronto when the lake is open, about eight months of the year. There are several beautiful parks, and on the lake shore Burlington beach has good bathing facilities and many summer homes.

Outstanding manufactures are iron and steel, agricultural implements, furniture, footwear and clothing. There is a large open-air fruit market. The plain between the water front and the escarpment, or what is called the mountain, is a good fruit-growing district. Large crops of peaches and other stone fruit are raised.

A settlement was founded in 1778 by Robert Land. The city is named after George Hamilton, son of Hon. Robert Hamilton, who bought the site of the present city in 1813 and founded a village. Hamilton was incorporated as a city in 1846. Pop. 1921, 114,151; 1931, 155,547.

HAMILTON, a municipal burgh of Lanarkshire, Scotland, lying about a mile from the confluence of the Avon and the Clyde, and about 11 mi. southeast of Glasgow. Of 15th century origin, it has many antiquities which include the ruins of Cadzow Castle in High Park, a possible relic of the ancient Caledonian Forest, where wild cattle roam among great oaks. Hamilton draws prosperity from the coal and ironstone of the region which is also celebrated for apples and market-gardening. Pop. 1921, 39,420; 1931, 37,863.

HAMILTON, a city of southwestern Ohio, the county seat of Butler Co., situated on the Great Miami River, about 25 mi. north of Cincinnati and 31 mi. southwest of Dayton. The Baltimore and Ohio and Pennsylvania railroads, electric and bus lines and an airport serve the city. Manufactures which are extensive and important, include auto parts, paper, safes and vaults, stoves, machinery and castings. In 1929 their value was about $66,000,000; the retail trade amounted to $28,153,292. The city is located in a fertile valley, which yields crops of corn, wheat and oats. Hamilton was the first municipality to own its gas and electric plants and water-works. Among distinguished people born in the city are Fannie Hurst, writer, Kenesaw Mountain Landis, high arbiter of baseball, and Albert M. Shaw, editor. William Dean Howells spent his boyhood here and described Hamilton in *A Boy's Town.*

In 1791, Gen. Arthur St. Clair built Ft. Hamilton on land now within the city limits. This fort was occupied by Gen. Anthony Wayne as a base of operations in the warfare that opened up the Northwest Territory. The town was laid out in 1796 and called Fairfield; it was later renamed for Alexander Hamilton. Hamilton was incorporated as a city in 1857. Pop. 1920, 39,675; 1930, 52,176.

HAMILTON COLLEGE, at Clinton, N.Y., a privately controlled and non-sectarian institution for men. It is an outgrowth of Hamilton-Oneida Academy, founded in 1793 by Samuel Kirkland, a missionary of great influence among the Oneida Indians, and chartered as a college in 1812. Alexander Hamilton was one of the original trustees. Its productive funds in 1931 amounted to $4,182,132. The library contained 142,214 volumes. The student enrollment in 1931-32 numbered 451; the faculty of 44 was headed by Pres. Frederick C. Ferry.

HAMITO-SEMITIC, a LINGUISTIC FAMILY comprising SEMITIC, Ancient EGYPTIAN and COPTIC, BERBER, and KUSHITIC. The correspondences noted between the four groups are above all morphological, and concern not only their details of expression, which in itself is demonstrative of their unity, but also their grammatical structure. Thus, *n* everywhere denotes the first person plural. The phrase is composed of separate words whose characteristics and functions are indicated by suffixes, prefixes, vocalic alternations (*see* ALTERNATION, VOCALIC), etc. Personal inflections denote the subject in the verb, which is clearly distinguished from the noun, as well as the complement of the verb and noun; and various changes in the verb-stems indicate causatives, reflexives, etc. Generally speaking, the phonetic aspect of all Hamito-Semitic languages is characterized by the presence of "emphatic" and laryngeal consonants, abundance of dentals, and paucity of labials. Detailed phonetic correspondences cannot be determined until a comparative etymology of Hamito-Semitic shall have been established; thus far only a small number of identical words have been observed, e.g., *mwt,* "die," in Semitic and Egyptian=*mmt* in Berber. Attempts to prove a connection between Hamito-Semitic and other AFRICAN languages have frequently been made. HAUSA shows some striking agreements with it. M. C.

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HAMLET, Shakespeare's longest play, the profound tragedy of an introspective soul caught between intellectual doubts and the inexorable necessity to act. It was first acted and entered on the register in 1602. The first extant edition was printed in 1603. *Hamlet* seems to have been based upon a lost play, probably by Kyd. The story appears, first told at length, in the

Historia Danica by Saxo Grammaticus and was adapted by Belleforest in his *Histories Tragiques,* about 1570. It deals with the mental anguish which overwhelms Hamlet, Prince of Denmark, when he discovers from his father's ghost that his uncle, Claudius (now also his stepfather), has gained the Danish throne by murdering the elder Hamlet. In order to prove Claudius's guilt, Hamlet engages a group of strolling actors to act before the king a play representing a murderous usurper. Then, convinced, the somber hero, who has feigned madness, slays the father of Ophelia whom he had loved, the sententious Polonius, in mistake for Claudius. Ophelia, in a genuine fit of madness, is drowned. Hamlet is sent by Claudius to England in the company of two fellow students who have instructions to have him murdered, but escapes by a ruse and returns to Denmark just in time to witness the funeral of Ophelia. In desperation Claudius arranges a duel between Hamlet and Ophelia's brother, Laertes. The duel, with its envenomed sword and poisoned wine, brings death to Claudius, to Hamlet's mother and Laertes, and, at last, to Hamlet himself.

HAMLIN, HANNIBAL (1809-91), 15th Vice-President of the United States, was born at Paris, Me., Aug. 27, 1809. After attendance at Hebron Academy, he worked successively on his father's farm, as a school teacher, and as a journalist, before studying law and being admitted to the Maine bar. He entered public life as an anti-slavery Democrat with his election to the Maine Legislature in 1835, and became a member of the House of Representatives in 1842, and of the Senate in 1848. In 1856 he was elected Governor of Maine as candidate of the newly organized Republican Party, but he resigned almost immediately to re-enter the Senate. In 1861 he became Vice-President of the United States, holding this office until 1865. Throughout the contests over slavery before the Civil War, Hamlin was a strong free-soil advocate, and during the war he upheld President Lincoln's policies, his advice frequently influencing Lincoln's decisions. He was re-elected Senator in 1869 and served until 1881, when he became Minister to Spain. He retired in 1883, and died at Bangor, Me., July 4, 1891.

HAMLINE UNIVERSITY, at St. Paul, Minn., a coeducational institution established in 1854 at Reading, Minn., controlled by the Methodist Episcopal Church. Its productive funds in 1931 were $1,863,627. The library contains 31,000 volumes. In 1930 there were 500 students, and a faculty of 33 headed by Pres. Alfred F. Hughes.

HAMM, a German city in the province of Westphalia, located on the Lippe River and Lippe Canal. It has an important iron industry (Krupp United Steel Works), and locomotive works. The formerly fortified town was the capital of the County of Mark and with it fell to Brandenburg in 1660. Hamm has a Protestant parish church of the 13th-14th centuries and a Catholic church built in 1510. For a time it was a Hanseatic city. Pop. 1925, 50,040.

HAMMER, perhaps the oldest of the hand tools, comes down from the stone age. It consists of a striking head and a handle. In the primitive stone hammers, the handle was split and the stone bound between the split ends. The modern steel hammer has an "eye" forged in the head and the handle is fastened in place by expanding its end with a wedge. Hammers are made in many sizes and shapes, from the tiny hammer for the jeweler to the blacksmith's sledge. The carpenter's or "claw" hammer has a flat face for driving nails and claws for pulling them out. The usual machinist's or ball-peen hammer has a flat face on one end of the head, while the other end is rounded. The rounded end is called the peen. Hammers are usually designated as ball-peen, straight-peen or cross-peen. Coppersmiths, steel workers and blacksmiths use special types of hammers that meet the requirements of their work.

HAMMERFEST, a harbor of Norway in the district of Finmark on the western coast of Kvalo Island, in 70° 40′ N. lat. The most northerly city in the world, it was founded in 1787 and rebuilt after the fire of 1890. It has a Protestant and a Catholic church. There are large fisheries, and cod liver oil is exported. The chief trade is with Russia, England and Germany. From Nov. 18 to Jan. 23 the sun does not rise, but in the summer the "midnight sun" remains above the horizon, even at its lowest culmination, 65 days. The sun produces peculiar light effects, particularly warm shadows and a weird twilight. Pop. 1930, 3,646.

HAMMER-HEAD, a large voracious SHARK (*Sphyrna zygaena*), 15 to 20 ft. long, found in all warm seas. It has an oddly-formed, hammer-shaped head, twice as wide as long, with the eyes placed at the outer ends.

HAMMER THROWING, one of the recognized athletic events of modern track and field championships, including the OLYMPIC GAMES. It has been popular in Ireland and Scotland for centuries. Until the end of the 19th century, throwers used a regulation blacksmith's hammer with a wooden handle, weighing either 21 or 16 pounds. The present official hammer consists of a ball of lead attached by a ball-bearing swivel to a wire handle. Its total length must not exceed 4 feet. Two weights are recognized, the 12-pound used in high schools, and the 16-pound used by men.

The throw is made from a 7-foot circle. The right-handed competitor places the ball of the hammer on the ground at his right side, grasping the hand loop firmly with both hands. Lifting the hammer, he swings it around his head, at the same time turning rapidly two or three times and releasing the hammer after obtaining the greatest possible momentum. Great strength is required in champion hammer throwers, and most of them have been big men.

HAMMER-TOE, a deformity characterized by the bending upward of the first joint of the toe and the bending downward of the other two. It is usually caused by wearing shoes that are too short or too

narrow at the toes. By wearing shoes of the proper form the condition may frequently be relieved.

HAMMOND, JAMES BARTLETT (1839-1913), American inventor, was born in Boston Apr. 23, 1839. He studied at the University of Vermont and during the Civil War served as newspaper correspondent. He later was graduated from Union Theological Seminary and continued his studies in Germany. Becoming interested in mechanics, in 1880 he built one of the first scientifically constructed typewriting machines. He introduced the ideal keyboard and true alignment in the machine which bears his name, and in 1884 commenced the manufacture of the Hammond machine, accumulating a large fortune. He left his valuable estate to the Metropolitan Museum of Art. He died in New York Jan. 28, 1913.

HAMMOND, JOHN HAYS (1855-), American mining engineer, was born at San Francisco, Calif., Mar. 31, 1855. After graduation from the Sheffield Scientific School at Yale, he was employed by the U.S. Geological Survey, resigning to become a consulting engineer. He was next associated with CECIL RHODES and was retained by the British South Africa Co. In the Transvaal in 1895-96 he joined the reform movement, and as a result was arrested by the Boers and sentenced to death. The sentence was changed to 15 years' imprisonment, and this was reduced to a fine of $125,000. Hammond was appointed general manager of the Guggenheim Exploration Company in 1903; in this post he developed mining properties throughout the world.

HAMMOND, a city in Lake Co., northwestern Indiana, situated at the foot of Lake Michigan, on the Calumet River and the Indiana Ship Canal, about 20 mi. southeast of Chicago. It is served by several railroads. The Lansing Airport of the Ford Motor Co. is 2 mi. south. Hammond's principal industry is the manufacture of railroad cars and equipment. There are also steel and chemical works, large oil refineries and other industries. In 1929 the manufactures were valued approximately at $71,000,000; the retail trade reached a total of $29,994,089. The city, originally a settlement called State-Line which grew up around the packing plant of George Hammond, was chartered in 1883. Pop. 1920, 36,004; 1930, 64,560.

HAMMOND, a city in Tangipahoa Parish, southeastern Louisiana, 45 mi. northwest of New Orleans. Two railroads afford transportation. The city has lumber mills and box and ice cream factories. It is the seat of Louisiana State College. Hammond is a shipping point for vegetables, dairy products and fruit. Pop. 1920, 3,855; 1930, 6,072.

HAMMONTON, a town of Atlantic Co., N.J., located on the Pennsylvania and Reading railways halfway between Atlantic City, N.J., and Philadelphia, Pa. It is the trading center for a fertile truck-gardening and fruit-growing area notable for its production of sweet potatoes, strawberries, raspberries, peaches and apples. There are several important industries, including the manufacture of shoes, cut glass and clothing. Pop. 1920, 6,417; 1930, 7,656.

HAMMURABI (2124-2081 B.C.), sixth ruler of the first dynasty of Babylon, and one of the greatest figures of the ancient world, was the son of Sinmuballit (2143-2124 B.C.). His glorious reign of 43 years was marked by the consolidation of Babylonia into a strongly centralized empire, the reorganization of the administration of justice, and the orderly arrangement of the laws and customs of the land. Hammurabi undertook several successful campaigns of conquest. In his inscriptions, numerous exploits of war are recorded; notably the taking of Uruk and Isin (2117 B.C.), and the victory over the Elamite troops in 2094 B.C., resulting in the capture of King Rim-sin and the downfall of the dynasty of Larsa. He encouraged agriculture, cut canals, built bridges and improved public buildings. But wonderful though these achievements were, this wise king is chiefly celebrated for his monumental Code of Laws, which is preserved to us on a stele of black diorite discovered at Susa. It is the oldest known law code in the world, and has been justly called "one of the most important documents in the history of the human race." The remarkable prologue to the Code states that Hammurabi promulgated the laws so that "the strong oppress not the weak, that the orphan and widow be protected."

HAMPDEN, JOHN (1594-1643), English statesman, was born in Buckinghamshire in 1594, and educated at Oxford. In 1621 he entered Parliament where he supported Eliot, Pym and Essex in opposing the arbitrary policies of Charles I. His outstanding act of defiance was his refusal to pay the Ship-money tax and he became the principal defendant against the Crown in the case of the King vs. John Hampden over the legality of the obsolete ship money. The case was decided against him but in 1641 the House of Lords ordered the judgment cancelled. Nevertheless he was impeached as one of the "fine members" in 1642. At the outbreak of the Civil War he organized and commanded a regiment, became a colonel under Essex in the parliamentary army but was mortally wounded in the battle of Chalgrove Field, June 18, 1643, and died June 24, 1643.

HAMPDEN, WALTER (1879-), American actor, was born at Brooklyn, N.Y., June 30, 1879. He was a student at Harvard, 1896-97, and began his theatrical career in Brighton, England, Sept. 2, 1901, by "walking on" in F. R. Benson's company. After playing more than 70 rôles with Benson in classical plays until 1904, he appeared at the Adelphi, London, taking leading parts in *The Prayer of the Sword* and similar romantic dramas. At the Court Theatre, London, he played Meleander. On the illness of H. B. Irving, Hampden acted Hamlet for one week at the Adelphi. After taking "leads" in Hall Caine's dramas, Hampden came to New York under Henry Miller and made a success as Manson in Kennedy's *The Servant in the House.* Hampden won recognition in New York and throughout America, mainly with the superior quality of his Hamlet and such successes as *Cyrano de Bergerac,* National Theatre, New York,

1928, and *Caponsacchi,* Hampden's Theatre, New York, 1926. He succeeded JOHN DREW as president of *The Players.*

HAMPDEN-SIDNEY COLLEGE, an institution for men at Hampden-Sidney, Va., controlled by the Presbyterian Synod of Virginia. It opened as Hampden-Sidney Academy in 1776, and was incorporated as Hampden-Sidney College in 1783. The library contains 20,000 volumes. In 1930 there were 259 students enrolled, and a faculty of 18, headed by Pres. J. D. Eggleston.

HAMPTON, WADE (1754-1835), American general, was born in South Carolina in 1754. He first distinguished himself in the Revolutionary War under Generals Sumter and Marion. From 1795-97 and from 1802-05 he represented his state in Congress. He was promoted in 1809 to the rank of brigadier-general in the United States Army. In 1813 he was appointed to command Norfolk during the War of 1812. Soon after this appointment he was given command of the army on Lake Champlain, and was expected to cooperate in threatening Montreal. Because of Hampton's refusal to support General Wilkinson, his colleague, the attack on Montreal resulted in failure. In 1814 he resigned from the army, and devoted himself to his plantation in South Carolina. He died at Columbia, S.C., Feb. 4, 1835.

HAMPTON, a port city in southeastern Virginia, the county seat of Elizabeth City Co., situated at the mouth of the James River, on Hampton Roads, 4 mi. from Newport News. The Chesapeake and Ohio Railroad and ferries serve the city. Langley Field, connected with the United States Army Air Corps is situated at Hampton. Seafood industries are the chief local interest. BOOKER T. WASHINGTON was educated at Hampton Normal and Agricultural Institute. Hampton was the home of President TYLER and George Wythe, a signer of the Declaration of Independence. The city was burned during the Revolution; the War of 1812, and the Civil War. It was founded in 1610 and became a city in 1908. Pop. 1920, 6,138; 1930, 6,382.

HAMPTON COURT PALACE, formerly a British royal residence, 1 mi. from Hampton, Middlesex, England, on the Thames, 15 mi. southwest of London. Cardinal Wolsey erected the palace, which is built of red brick, in 1515, and presented it in 1526 to Henry VIII, who added the Great Hall and the Gothic chapel. It is one of the finest examples of Tudor architecture. Of the original quadrangles, only two of the five remain; but a third was added by SIR CHRISTOPHER WREN for William III (17th century). Upward of a thousand rooms are in the palace, most of which are allotted in suites to certain pensioners of the crown. The palace was a royal residence till the reign of George II.

HAMPTON INSTITUTE, at Hampton, Va., a coeducational institution for Negroes and Indians, was founded by Gen. Samuel Chapman Armstrong in 1868. For two years it was controlled by the American Missionary Association, but in 1870 became independent of denominational control. The school was first opened to provide a practical education for the children of former slaves. In 1878 Indians were admitted as students, and since then the Indian department has increased steadily. The institution comprises preparatory, industrial and normal departments. The students assist in the manual labor about the school. BOOKER T. WASHINGTON of the class of 1875 is the most noted graduate. In 1923 Hampton Institute was organized as a Teachers' College and is credited as such by the United States Office of Education. It had productive funds in 1931 of $9,464,310. The library contained 78,464 volumes. In 1931-32 there were 1,087 students and a faculty of 164, headed by Pres. ARTHUR HOWE.

HAMPTON ROADS, a channel through which the waters of the James, Nansemond and Elizabeth rivers of Virginia pass into Chesapeake Bay. It separates Fortress Monroe, on Old Point Comfort, from Sewell's Point, to the south. It is important for its drydock and terminal facilities, and is used as a base by the U.S. Navy. Ft. Monroe and Ft. Wood, which is on a small island near the middle of the channel, defend the entrance to Chesapeake Bay. An important navy yard is located at Portsmouth, a few miles up the Elizabeth River. In the Civil War on Mar. 9, 1862, the *Monitor* and *Merrimac* engagement, the first battle between iron-clad vessels, occurred here.

HAMPTON ROADS CONFERENCE, Feb. 3, 1865, an informal attempt to promote peace between the Confederacy and the Federal Government, arranged by Francis P. Blair, Sr., retired editor of the Washington *Globe.* Aboard the steamer *River Queen,* anchored in Hampton Roads, President Lincoln and Secretary of State Seward met commissioners appointed by Jefferson Davis: Alexander H. Stephens, vice-president of the Confederacy, R. M. T. Hunter and John A. Campbell, members of Davis's cabinet. Stephens directed the conversation to a project to vindicate the Monroe Doctrine by driving the French out of Mexico, a proposal to unite North and South by the diversion of a foreign war; Lincoln was not interested. Seward and Lincoln expressed willingness to compensate the South for the emancipation of the slaves, but insisted that no agreement could be entered into until arms had been laid aside and Federal authority completely restored. As Davis had instructed his commissioners to consider no terms short of absolute independence of the Confederate states, the four hours' conference was without result.

HAMSTER (*Cricetus cricetus*), a stout little rodent, about 10 in. long, with cheek pouches and a short, hairy tail, inhabiting parts of Europe and Asia. Highly distinctive of the hamsters are their elaborate burrows; these are constructed in dry, not sandy, soil 4 or 5 ft. below the surface. There are several chambers and a separate entrance and exit. One chamber is used as a granary for large quantities of corn stored for use during the severest winter months, when the hamster hibernates. At this time the passages above

ground are closed with earth. Hamsters are exceedingly prolific, and they sometimes overrun fields in destructive swarms. The fur, though poor, is occasionally used for coat-linings and the flesh is occasionally eaten.

HAMSUN, KNUT (1859-), Norwegian novelist, was born at Lom, in Gudbrandsdalen, Aug. 4, 1859. In his youth he began to learn the shoemaker's trade, at the same time trying his hand at writing. He first attracted attention with *Hunger,* a realistic picture of a young author's struggles. Most of Hamsun's novels depict peasant life in Norway. *Growth of the Soil* is usually considered his best work and one of the world's great novels. Among other books are *Victoria, Benoni, Rosa, Children of the Age, Segelfoss Town, The Women at the Pump, Vagabonds* and *August.* He was awarded the Nobel Prize for Literature in 1920.

HAMTRAMCK, a city of southeastern Michigan, in Wayne Co. It is near the city of Detroit and is served by two railroads and numerous bus lines. It is an important manufacturing community, which has grown tremendously since it was organized as a village in 1901. In 1910 the population was 3,559, but by 1920 it had risen to 48,615. In 1922 Hamtramck received a city charter. The total value of its manufactures in 1927 was $263,285,887, with automobiles, automobile accessories and paint the principal products. In 1929 there were 649 retail stores in Hamtramck, which did a total business of $22,585,412 and gave full-time employment to 1,288 men and women. The city owes its name to Col. Jean François Hamtramck, first American commander of the fort at Detroit. Pop. 1921, 48,615; 1930, 56,268.

HANAU, a city in the Prussian province of Hesse-Nassau, located on the Main River about 11 mi. east of Frankfort-on-Main, in a fertile region. It was once capital of the County of Hanau. In the old town, with its crooked streets, is the former rathaus with collections of the historical society. The newer part of the town, with regular streets, was laid out in 1597 by Reformed Netherlanders. Their gold and silversmith trades still flourish. Its important industries include diamond cutting, tobacco and rubber manufacturing and timber working. Hanau is the birthplace of the brothers, Jacob and Wilhelm GRIMM. Pop. 1925, 38,498.

HANCOCK, JOHN (1737-93), American Revolutionary statesman, was born at Quincy, Mass., Jan. 12, 1737. He graduated from Harvard College, 1754, and after experience as a clerk in the counting-house of an uncle and a visit to England, he inherited the large estate of his uncle in 1764. As one of the most prominent Massachusetts merchants, he opposed the mercantile policies of the British government and thereby endeared himself to the Boston populace. A member of the Massachusetts general court 1766-72, he was outspoken in denunciation of the infringement of colonial rights and of the presence of British troops in Massachusetts. It was for the purpose of arresting Hancock and Samuel Adams that the British troops marched to Concord, Mass., Apr. 1775; the Battle of Lexington and Concord was the consequence. Hancock was exempted from a general amnesty proclaimed by General Gage of the British forces, June, 1775.

Hancock was unanimously elected president of the Massachusetts provincial congress, 1774, and was later elected president of the first and second Continental Congress, serving from May 1775 to Oct. 1777. He continued as a member of the Continental Congress until 1780. His bold signing of the Declaration of Independence led to the use of the term "John Hancock" as a slang synonym for signature. He was the major-general in command of the Massachusetts troops in Rhode Island, 1778. Generally recognized as the most popular man in Massachusetts, Hancock was chosen president of the Massachusetts constitutional convention, 1780, and was elected the first governor of the new government, serving from 1780-85 and again from 1787 until his death. He presided at the Massachusetts convention for the ratification of the Federal Constitution. Although he earlier had opposed it, he changed his attitude and his support was an important factor in the ratification of the document. He died at Quincy, Mass., Oct. 8, 1793.

HANCOCK, WINFIELD SCOTT (1824-86), American soldier, was born in Montgomery Square, Pa., Feb. 14, 1824. He graduated at West Point and served in the Mexican War where he showed marked ability as a soldier. When the Civil War broke out he was appointed brigadier-general of volunteers in the Army of the Potomac. He fought at Williamsburg, Antietam, Fredericksburg and Chancellorsville, being put in command of the 2nd Corps. He commanded with singular distinction at Gettysburg (July, 1863), where he held Cemetery Hill and Ridge, and checked Pickett's famous charge. In 1864 he commanded half the Federal army in the Second Battle of the Wilderness, and fought at Spottsylvania Courthouse and Cold Harbor. In Aug. 1864 he was made brigadier-general in the regular army. When Lincoln was assassinated in Apr. 1865, and Washington was placed under martial law, Hancock was given charge of the city and conducted the trial and execution of the conspirators. In 1866 he was made major-general in the regular army and placed in command of the department of Missouri, and later of Louisiana and Texas. General Hancock was Democratic nominee for President of the United States in 1880, but was defeated by Garfield. He was in command of the Department of the East when he died on Governor's Island, New York, Feb. 14, 1886.

HANCOCK, a city in northwestern Michigan, in Houghton Co., situated on Lake Portage, 12 mi. southwest of Calumet. The city connects with Lake Superior by the Portage ship canal, and is served by Lake steamers and two railroads. Copper is found in the vicinity; hence Hancock is called "the Hub of the Copper Country." Copper refining and creamery work are the chief local industries. Dairying and grain growing are the leading interests of the region.

The Finns predominate in the city, and it is the seat of a Finnish College. Hancock was incorporated as a city in 1903. Pop. 1920, 7,527; 1930, 5,795.

HAND, the terminal portion of the upper extremity used in holding and grasping objects. The retention of primitive characters in the human hand and its usefulness in prehensile and other complex movements are to a great extent responsible for the dominance of man among mammals.

The bones of the hand are considered in the article SKELETON, the arteries are discussed in ARTERIAL SYSTEM, the nerves in NERVOUS SYSTEM, and the muscles in MUSCULAR SYSTEM.

HANDBALL, a game requiring only a wall and a ball, which is struck with the bare hand. In the United States, where it is chiefly played, the game has achieved such popularity that most gymnasiums are equipped with special handball courts. The game is an ancient one in Ireland, from where it was brought to this country about 1840. Under the regulations of the Amateur Athletic Union, one-wall handball is played on a court 34 feet long and 20 feet wide, facing a wall 16 feet high. The court is traversed by two lines: the short line, 14 feet from the wall, and the service line, 9 feet behind the former. When serving, the player bounces the ball in the area circumscribed by the two lines so that it will strike the wall. The ball may be returned by the opposing player while in mid-air or after the first bounce. The conventional ball is 1⅞ inches in diameter and weighs 2 ounces. Game consists of 21 points, scored by a player on the basis of his opponent's number of failures to return the ball. Tournament matches consist of the three best out of five games. Both singles and doubles may be played. Four-wall handball is played on a rectangular court bounded by walls 46 x 22 feet, and is entirely an indoor game. In recent years, the singles winners in the one-wall finals of the National A.A.U. were Max Gold of Los Angeles, 1920; M. Laswell of Los Angeles, 1925; Fred Schmidt of New York City, 1930, and Alfred Banuet of San Francisco, 1931.

HANDEL, GEORGE FREDERICK (1685-1759), German music composer, was born at Halle, Feb. 23, 1685. The contemporary of J. S. BACH, he shares with him a uniquely exalted position in German music, although, strange to say, the paths of the two geniuses never met. A child prodigy, he taught himself to play the harpsichord when he was less than seven, at which time the Duke of Saxe-Weissenfels, impressed by his talent, arranged for his tutelage under Zachau, organist of Halle Cathedral. For three years he composed a motet for every Sunday, meanwhile serving as assistant organist at the cathedral. In 1697 his father died, and in fulfillment of his parent's wishes, he entered Halle University in 1702 as a law student. But the call of music was imperative, and in 1703 he went to Hamburg, where he played the violin in the German Opera-house. Journeying thence to Italy he met Alessandro Scarlatti, and absorbed many tendencies of Italian opera, returning to Germany in 1709. The following year he was appointed capellmeister to the Elector of Hanover (afterward George I). Soon afterward he visited England, where his opera *Rinaldo* was produced in 1711. Thereafter he spent so much of his time in London that many Englishmen began to consider him a British genius. In 1720, having meanwhile served as capellmeister to the Duke of Chandos, he took over the direction of Italian opera at the Royal Academy of Music, and in 1734 he inaugurated his ill-starred career as an operatic impresario, producing his operas at both Lincoln's Inn Fields and at Covent Garden. He soon went bankrupt and his health began to fail. In 1741, at the age of fifty-six, his long career as an operatic composer ended, but he was by no means finished with music. At this juncture he began a new career as the composer of the greatest oratorios in musical literature. Already, in 1739, he had produced *Saul* and *Israel in Egypt;* but it was only on April 13, 1742, that *The Messiah* was first performed in Dublin. Thereafter followed in rapid succession *Samson, Joseph, Occasional Oratorio, Judas Maccabaeus, Joshua, Solomon, Susannah, Theodora,* and *Jephtha.*

Handel composed more than 30 operas, 16 harpsichord suites, more than a dozen oratorios, innumerable cantatas, and about 30 organ concertos, in addition to various shorter pieces. A complete edition of his compositions, issued by the German Handel Society, embraces 100 volumes. It is to the oratorios, however, that the musical world turns for the true measure of Handel's genius; for there, apparently almost an after-thought of his long life, is imprisoned the very core of his inspiration. His last oratorio, *Jephtha,* was composed when he had become almost blind. Undaunted, he continued to play the organ, joining in a performance of *The Messiah* only a few days before he died at London, Apr. 14, 1759. He was buried in Westminster Abbey.

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HANDICAPPED CLASSES. In modern work with the handicapped, their assets rather than their handicaps are emphasized. That the large majority can be enabled to lead happy and useful lives has been demonstrated, but such constructive training programs still await general application.

The Feeble-minded. Stunted intelligence and social inadequacy in combination constitute feeble-mindedness. As measured by the usual tests, degree of intelligence is expressed as the mental age, based on achievements of average children of a given life age, or as a percentage of normal intellectual development, called the intelligence quotient. The standard classification is idiots, with mental ages up to 2 years; imbeciles, 3 to 7; morons, 8 to 12.

Idiots and imbeciles represent about one-half of 1% of the total population. An additional 1% or less of the total population represents the feeble-minded of the moron group. Altogether, the identifiable feeble-minded are estimated at 1% to 2% of the total population in the United States. In 1931, institutional facili-

ties for the feeble-minded only in the United States are available for 60,000, or 6%, based on the conservative estimate of 1,000,000.

The task of training falls principally upon the institution and the public school. The institution is especially adapted to the care and treatment of idiots and imbeciles and to the training of socially troublesome morons. It aims to socialize the individual and thereby enable him to make the most of his limited intellect. Low-grade cases are brought thereby at least to a greater degree of self-help, comfort and happiness, while a limited number of higher-grade cases are enabled to return under supervision to community life and to become more or less self-supporting.

The largest task of training falls upon the public school in giving special education to backward and retarded children (not less than 2% of the school population) most of whom can be prevented from becoming antisocial and typically feeble-minded by means of proper training and guidance. Studies show that the large majority of graduates of special classes, with the aid of the practical and industrial training received therein, are able to remain acceptably in the community and contribute largely to their self-support. Another agency of great importance in the modern program is community supervision as organized by state and other agencies. *See also* MENTAL DEFICIENTS, EDUCATION OF.

The Blind. Blind children in the United States are estimated at 15,000. Although education for the blind is compulsory in most states, only 6,000 were receiving this special education in 1931. Less than 500 of these were in day school classes, the remainder being in 51 state and 10 private residential schools.

The primary purpose of the education of the blind is to enable them to enter normal social life. The teaching of Braille (*see* LOUIS BRAILLE) as a medium of instruction is only incidental to the development of the social type of personality, physical training, recreational opportunities, vocational preparation and social contacts. Prevention of blindness consists chiefly of sight-saving classes in the public schools for partially-seeing children whose number is estimated at 50,000, and prophylactic measures following birth against ophthalmia-neonatorum, or babies' sore eyes. Blindness from the latter cause has been reduced in 25 years from 28 to 9% of all admissions to schools for the blind. *See also* BLIND, CARE AND EDUCATION OF.

The Deaf. Children with impaired hearing in the United States are estimated at 3,000,000. An undetermined proportion of these are so deaf as to need lip-reading lessons. Sixty school systems in 1931 provided special lip-reading classes. Early discovery, proper diagnosis, medical treatment and special training, are keynotes of the modern program. Much further research is needed in lip-reading, speech-teaching and vocational training. *See also* DEAF, EDUCATION OF; DEAF-MUTISM.

The Crippled. While crippled children in the United States are estimated at 300,000, only a fraction have come to public attention and have been given the advantages of excellent existing facilities for orthopedic surgery, medical treatment and vocational training. The immediate task is by various methods to find the crippled children and to provide for their treatment and education at public expense, including industrial training, vocational guidance and placement in remunerative employment. S. P. D.

HANDLING OF MATERIALS. *See* MATERIAL HANDLING.

HAND PREPARATIONS, lotions for use after washing the hands to keep them soft and prevent chapping. These are of various types, glycerin and rose water being the most common. For skin that is harsh and easily chapped, fatty creams are used containing cocoa-butter or lanolin. Generally, the same preparations recommended for the complexion may be also used for the care of the skin or the hands. *See also* FACE PREPARATIONS; MANICURE PREPARATIONS.

HAND PRESSES. *See* PRINTING PRESSES.

HAND-TO-MOUTH BUYING, a phrase which attained wide usage and discussion among business men and economists during 1920-30. It was used to designate certain trade practices consisting chiefly of placing orders less far in advance than had been the custom and of placing orders for smaller quantities than had usually been the case. Careful research of quantitative data made toward the end of the decade demonstrated that while these methods were being extensively and in some cases increasingly employed, they were by no means universal in American trade. In the canning industry advance ordering had greatly lessened, but in some other lines the change was small or not apparent. Small orders had grown in relative frequency, but in some instances this had been accompanied by an unprecedented number of very large orders—the latter apparently reflecting the new concentration of purchasing power of CHAIN STORES. One effect of hand-to-mouth buying was to lessen the inventory as a percentage of sales, particularly in manufacturing.

Investigations show that the symptoms known as hand-to-mouth buying were discussed in business periodicals as early as 1850, the actual phrase being used in the dry goods trade in 1868. Indeed, for 40 years following the Civil War continuous complaint of hand-to-mouth buying practices was common in many industries. During the years 1920 to 1930 hand-to-mouth buying was attributable chiefly to price trends, new ideas of efficiency, inventory control, rapid style change, improved communication and improvements in transportation. L. S. L.

HAND TOOLS. *See* TOOLS, HAND.

HANFORD, a city in southern California, the county seat of Kings Co., 33 mi. south of Fresno, served by the Southern Pacific and Santa Fe railroads. There is an airport. Fruit, cotton and dairy products are the principal agricultural interests. Hanford has creameries and fruit and vegetable canneries and is the trading and recreational center for the workers in the great Kettleman Hills Oil Fields.

Hanford was founded in 1887 by the Southern Pacific Railroad. Pop. 1920, 5,888; 1930, 7,028.

HANGAR, a building in which an AIRPLANE is stored and serviced, as is an automobile in a garage. It may be a small privately owned one-plane structure or, as at several AIRPORTS, be able to care for all the planes owned by one company or those attached to one military unit. The first hangars, usually built of galvanized iron, contained only storage room for the airplane and for gasoline and oil supplies, spare parts and tools, and possibly a bunk for a watchman or mechanic. Now some of the brick and concrete airport hangars shelter many large planes, with equipment for their care, several gasoline and oil pumps, a waiting room for passengers, a public restaurant and living quarters for employees.

HANGCHOW, the chief city, treaty port, and capital of the rich province of Chekiang on the middle coast of eastern China. It is situated on West Lake at the meeting of the River Tsien Tang with the East China Sea. An old Chinese proverb describes the city as one of the two most beautiful places in the country, saying "Above is Heaven, below SOOCHOW and Hangchow." The city spreads into hills thickly wooded, and encrusted with temples owning great wealth and renowned works of art. Among the noted religious retreats is Lin Yin on whose rocks are carved the Laughing Buddha and other figures in the Buddhist theology. Evidences of historic Hangchow remain in her sacred relics and ruins of royal residence still standing on the shores of West Lake, covered in the summer with elaborately carved and painted pleasure boats. The city walls have been torn down for boulevards, and the modern sections rebuilt with wide streets for buses and motor cars as well as the native traffic of rickshas and wheelbarrows.

Hangchow is noted for its manufacture of silk, scissors, knives, and fans. Tea, cotton, and mulberry trees are grown. The long artificial waterway of China, the Grand Canal, begins at the city and carries its products into the North. Other connections which make Hangchow a commercial center for China are the River Tsien Tang, joining it with the interior of the province, and railroads extending the trade to the South, and also to the North through Shanghai.

Throughout China the natives of Hangchow are known for their enterprise and cultivation. The natural beauty of the surroundings has drawn not only groups of religious men but schools of artists whose flower paintings and scrolls are noted. Founded in 606 Hangchow became the capital of the Southern Sung Dynasty in the 12th century. The recent provincial and local governments have been progressive in giving the city water works, playgrounds, telephones, electricity, and running water. Marco Polo visited Hangchow in the 13th century. Pop. 1929, 426,916.

HANKOW, treaty port of Hupeh Province, China, and one of the most important commercial cities in the country. It is situated at the junction of the Han and Yangtze rivers, 600 mi. from the sea. In the customary usage, "Hankow" includes not only the old city of Hankow on the north bank of the Yangtze Kiang but also Wuchang on the opposite bank of the river and Hanyang across the Han.

At a point which can be reached by ocean going steamers, Hankow has been an important foreign and local trade center since its opening by treaty in 1862. The building of the railway to Peking in 1905 increased its trade importance. The factories of Hankow are exceeded in China only by those of Shanghai. An arsenal is at Hanyang, as well as iron and steel works which draw their materials from the Hupeh mines and the province of Kiangsi. At Wuchang is a mint.

By a series of treaties the British, French, Japanese, Germans and Russians secured concessions in Hankow. The Germans and Russians lost their concessions as a result of the World War and the Soviet Revolution respectively. In 1927 a Chinese mob overran the British concession and by the Chen-O'Malley Agreement of February 19, 1927, control of the former British concession was returned to the Chinese, subject to a minority participation in the administrative council of the British residents in the area.

Hankow has been the center of recurrent political and military disturbances, particularly since it was taken by the advancing Nationalist forces in 1926. This has checked the earlier rapid development of the city as a trading and industrial center. A very serious flood in the Hankow area in the summer of 1931 brought widespread property damage, and caused heavy loss of life, as well as putting a virtual stop to trade for a number of months.

The foreign residents of Hankow in 1929 numbered approximately 2,000, out of a total population of approximately 750,000.

HANKUTCHIN, a North American tribe, a subgroup of the Kutchin, belonging to the northern Athapascan division of the Athapascan linguistic stock. They live on the upper Yukon River in Alaska.

HANLEY, a market town of Stoke-upon-Trent county in Staffordshire, England, 148 mi. northwest of London. In 1910 it became part of STOKE-UPON-TRENT. It is well laid-out on high ground and has handsome schools, municipal buildings, an art museum, library and large park. It is one of the old five towns famed for porcelain and pottery manufacture and celebrated by the novelist, Arnold Bennett, who was born here. Pop. 1931, 78,000.

HANNA, MARCUS ALONZO (1837-1904), American industrialist and politician, was born in New Lisbon (now Lisbon), O. He moved with his parents to Cleveland in 1852, where he attended the common schools and later Western Reserve College at Hudson. He left college at the age of 20 before graduation to enter a wholesale grocery business of which his father was the senior partner. Extremely energetic and successful, Hanna's business activities were widened to include many industries.

Hanna liked to associate himself with politics, although at first he never sought office for himself.

He was a delegate to Republican National Conventions in 1884, 1888 and 1896. A personal friend and admirer of John Sherman, Hanna worked unsuccessfully to gain the Republican nomination for him in 1880, 1884 and 1888. In the Convention of 1888 Hanna was impressed by William McKinley who placed the name of Sherman in nomination. Hanna thereafter switched his presidential-promoting activities to McKinley and before the Convention of 1896 brought about the nomination of his choice.

Hanna was appointed chairman of the Republican national committee in 1896 and contributed importantly to the Republican victory. In 1897 he was appointed and later elected to the senatorship which Sherman vacated for the office of Secretary of State. Hanna was twice reelected, serving from Mar. 5, 1897 until his death. In the Senate he particularly interested himself in the project of a Central American canal and largely at his insistence the proposed route was shifted from Nicaragua to Panama. Extremely fair and kind in his dealings with the laborers of his own numerous enterprises, he was responsible for the creation of the National Civic Federation in 1901. He died in Washington, Feb. 15, 1904.

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HANNIBAL (247-183 B.C.), Carthaginian general, son of HAMILCAR BARCA. Assuming command of the Carthaginian army in Spain in 221 B.C. he completed the conquest of Rome south of the Ebro River. In 219 B.C. he besieged Saguntum, supposedly immune from attack by virtue of a treaty between Rome and Carthage. In spite of Roman protests Hannibal carried on the siege, capturing Saguntum at the end of eight months. As Carthage refused to repudiate this action Rome declared war. With amazing rapidity and daring Hannibal led his army, about 40,000 strong, over the Pyrenees, across the Rhone and over the Alps, showing great ingenuity in the management of his baggage train and his elephant corps. In the late autumn of 218 B.C. he defeated the Romans first at the Ticinus River and a few weeks later at the Trebia River. In the following spring after a bitter crossing over the Apennines he routed an army under Flaminius at Lake Trasimene. In 216 B.C. he won his greatest victory at the BATTLE OF CANNAE, in which about 50,000 Romans fell. For the next 13 years Hannibal maintained himself in Italy, his most notable success being the capture of Tarentum in 212 B.C., by which he gained direct communication with Carthage by sea. But in 211 B.C., Capua, which had espoused his cause after Cannae, was captured by the Romans, and in 209 he lost Tarentum. In 207 his brother Hasdrubal who had brought a relieving army across the Alps was defeated and killed at the Metaurus River. Hannibal was recalled to Africa to face Scipio in 203 B.C. The next year, 202 B.C., he was overwhelmingly defeated by Scipio at ZAMA, but his enemies freely acknowledged that his defeat was not due to any tactical blunder. After helping Carthage meet the obligations imposed by Rome, Hannibal withdrew into voluntary exile. Well received by Antiochus III of Syria, he aided him in his preparations for war against Rome. Defeated at the Eurymedon River in 190 B.C., Hannibal fled to Prusias, king of Bithynia. To avoid surrender to the Romans he took his own life. Hannibal's achievements in Italy are the more remarkable because he received practically no support from Carthage. He has been criticized for not attacking Rome directly after Cannae, but, a consummate strategist and tactician, he well knew the dangers and difficulties of conducting a siege with a comparatively small force. G. M. H.

HANNIBAL, a city in northeastern Missouri, in Marion Co., situated on the Mississippi River 120 mi. northeast of St. Louis. Bus lines, river craft and three railroads serve the city. The chief crop of this region is grain. Hannibal has many factories turning out buttons, stoves, shoes, car wheels and various other products. In 1929 the manufactures amounted to $21,000,000; the retail trade reached an approximate total of $10,590,757. The name of Hannibal is known chiefly as the town where Mark Twain spent his boyhood; the river afforded inspiration for *Life on the Mississippi, Tom Sawyer* and *Huckleberry Finn.* The cave described in *Tom Sawyer* is near the city; it was also a retreat for slaves escaping by the underground railway and a hiding place of Jesse James. Hannibal was founded in 1817 and incorporated in 1845. Pop. 1920, 19,306; 1930, 22,761.

HANO, a North American Indian tribe and village belonging to the Hopi group of pueblos in northeastern Arizona. Unlike the rest of the Hopi who are linguistically affiliated with the Shoshonean stock, the Hano speak a Tewan dialect. They migrated from the Rio Grande in New Mexico, from the pueblo called Tsawarii, early in the 18th century. They have intermarried with the Hopi, and though differing in language, culturally, they are typically Pueblo, living in permanent adobe houses, practicing agriculture, pottery-making, and having a clan organization with matrilineal descent.

HANOI, the chief city of Tonking and capital of French Indo-China, situated on one of the mouths of the delta of the Red River about 80 mi. inland. The city at one time stood on the sea and the early Dutch navigators traded with the seaport. Hanoi is now a modern city; the muddy land has been drained and planted with rice. The industries include cotton-spinning, brewing and the manufacture of tobacco and matches. Est. pop. 1930, 133,764.

HANOTAUX, ALBERT AUGUSTE GABRIEL (1853-), French statesman and historian, was born at Beaurevoir, Aisne, Nov. 19, 1853. After a period of government service he became a member of the Chamber of Deputies 1886-89, and served twice as foreign minister, from May 1894 to January 1895, and from November, 1895 to June, 1898. After 1886 he was known as a distinguished historian and was elected to the French Academy in 1897. His best-known work is probably his *Histoire de la France Contemporaine,* 1871-1900, the recognized authority

on its period (4 vols., 1903-08). He also wrote of the World War and the Treaty of Versailles, and among other books published a 15-volume *Histoire de la Nation Française* (1920-24).

HANOVER, capital of the former kingdom, now of the Prussian province of Hanover, located in a fruitful, well-cultivated plain on both banks of the Leine and its tributary, the Ihme, about 32 mi. west and north of Braunschweig. Broad meadows penetrate the city and the villa section is half encircled by extensive woods. From the viewpoint of the history of art, the city cannot vie with the neighboring cities, Hildesheim, Brunswick and Luneburg. The old city still has a few private buildings of the 16th and 17th centuries and an old rathaus of the 15th century, and there are several churches of the 13th and 14th centuries. The newer districts are regularly laid out with wide streets and splendid buildings, which make Hanover one of the finest German cities. Most noteworthy are the royal palace, built in 1636-40, the former royal theater, the art galleries and museums, with their rich collections, and Castle Herrenhausen, with its large formal gardens reminiscent of Versailles. The city is the seat of a technological institute and veterinary college. The important industrial plants include spinning mills, iron foundries and machine factories. Pop. 1925, 422,745.

HANOVER, a borough of York Co. in the fertile Conewago valley, near the southern border of Pennsylvania about 35 mi. south of Harrisburg. It is served by the Pennsylvania, the Western Maryland Railways, York Railways Co. and motor bus lines. It is not only an agricultural and business center for a rich farming region producing wheat, corn, hay and fruit, valued annually at about $2,000,000 but an important industrial point as well. More than 100 plants produce goods valued at over $15,000,000. Manufactured products include shoes, gloves, cordage, textiles, furniture, wirecloth and leather.

Hanover was founded in 1763 by Col. Richard McAllister and incorporated as a borough in 1815. It is now run on the city manager plan. It was named for the German city, Hanover. The original Mason and Dixon line marker is nearby and Hanover marks the place where turnpikes cross each other. The Battle of Hanover, 1863, saw the first blood shed on Union soil, and on the next day occurred the Battle of Gettysburg, 14 mi. away. Pop. 1920, 8,664; 1930, 11,805; 1% foreign-born.

HANOVER, HOUSE OF. *See* WINDSOR, HOUSE OF.

HANOVER COLLEGE, a coeducational and nonsectarian institution at Hanover, Ind., was opened in a log cabin in 1827 at the request of the Presbytery of Salem, Ind. Begun as an academy, it was chartered as a college in 1833. The productive funds in 1931 were $739,209. There were 33,000 volumes in the library. In 1931-32 there were 305 students and a faculty of 21, headed by Pres. Albert George Parker.

HANSEATIC LEAGUE, an organization of North German cities in the Middle Ages to aid their foreign trade. Out of a number of separate city-by-city agreements, that between Lübeck and Hamburg in 1241 became the foundation into which the others were absorbed and to which new cities were joined. Bremen joined the league shortly, and in all some 70 cities were members at the height of the league's power at the end of the 14th century, and at numerous other towns, the league maintained offices or enjoyed trading rights. The league established rules governing foreign trade, binding on all members, maintained courts for commercial disputes, and secured trading privileges abroad, such as the market at Novgorod and the exclusive right of members to trade in England. At the height of its power the league carried on war with Denmark for the monopoly of the carrying trade in the Baltic. Late in the 15th century the inland German cities were forced away. The loss of the Baltic monopoly to the Scandinavian kingdoms in the 16th century coupled with the increased power of the English traders and the non-member cities on the Baltic reduced the importance of the league. In 1612 only 14 cities were members. In 1630 Lübeck, Bremen and Hamburg attempted to revive it by new agreements between themselves, repeating the attempt in 1641. Nothing could stop the decay, however. The last, and quite meaningless, meeting of the governing body of the league was at Lübeck in 1669. In part this decay was the result of economic shifts following the use of the Cape route to the Orient and the American trade, and in part the greatly increased power of the central governments, in the countries where the league cities had once enjoyed monopolies.

HANSE CITIES. *See* FREE CITY.

HÄNSEL UND GRETEL, an opera in three acts by ENGELBERT HUMPERDINCK, libretto based on the fairy tale of Grimm by Adelheid Wette; première, Weimar, 1893, New York, 1895. It is the foremost of the composer's several operas and is considered superior to *Die Königskinder*. Humperdinck carries on the Wagnerian tradition, and in this score evinces both strength and delicacy.

Hänsel and Gretel, children of a poor broommaker, are left at home alone to keep house together. When their mother returns she punishes them for spilling the milk which was to be their supper. The children are sent to the woods to pick berries. Forgetting the time, they wander away, and sleep under a tree when night comes, eventually discovering a beautiful gingerbread house. Inside lives a wicked old witch. When she espies the pair she invites them in, intending to roast them in her great oven. But Hänsel and Gretel turn the tables on the witch by pushing her into the oven. The oven explodes, the gingerbread house tumbles down, and out troop all the children she had killed previously. While they all dance together Hänsel and Gretel are found by their parents who join in the general merriment.

HANTIWI, a North American Indian tribe of the Shastan linguistic stock, a division of the ACHOMAWAI. They lived formerly in Warm Spring Valley, Calif.

HANUKAH, Jewish festival. *See* MACCABEES, FEAST OF.

HANUMAN, a monkey (*Pygathrix entellus*) native to India, called also the sacred langur. It is venerated by the Hindoos, as representing Hanuman, the monkey-god who assisted the mythic hero Roma. None may be killed, and in consequence they are a pilfering nuisance in the Indian markets. They are rather small, yellowish brown with very long tails and black whiskered faces. They travel about in small troops, and live mainly on fruits and leaves, in search of which they constantly invade and damage orchards and gardens. Their musical voices are raised in angry chorus at sight of a tiger, a warning often serviceable to men working in the jungle. E. I.

HAPGOOD, NORMAN (1868-), American editor and writer, was born in Chicago, Ill., Mar. 28, 1868. He graduated at Harvard in 1890. After 5 years as a dramatic critic in New York City, he served as editor of *Collier's Weekly,* 1903-12. In 1913-16 he was editor of *Harper's Weekly,* and in 1923-25 editor of *Hearst's International.* His published books include *Daniel Webster, George Washington, Abraham Lincoln* and *The Stage in America.*

HARA, TAKASHI (1856-1921), Japanese statesman, was born at Morioka. After study of law and journalism, he edited the progressive *Hochi* until 1882 when he became representative of the Foreign Office in Korea. After further service as Consul at Tientsin, Secretary of the Legation and Chargé d' Affaires at Paris he returned to Japan and joined Marquis Inouye and Count Mutsu and, in 1900, Prince Ito, in forming the Seiyuki Party. He became Prime Minister in 1918. Hara was a powerful leader in the efforts to establish the supremacy of the civilian over the military authorities in the government. He was one of the most important products and creators of modern liberal Japan. He was assassinated by a Korean fanatic at the Tokyo railway station, Nov. 4, 1921.

HARBIN, a city of northeastern China; one of the chief international trade markets of inland Manchuria. It is situated on the River Sungari in the low country of the Ashiho district, Kirin province. The city is divided into districts called the Foreign Town, Old and New Harbin, the Pristan, and the Chinese quarter, Fuktien. Its atmosphere is more Russian than Chinese. The leading section is Russian with Russian hotels and stores, and high-collared horses pulling droshkies down streets as wide as those of a Siberian village. The manufactures of flour and bean cakes are the chief industries. The importance of the city was derived from its position as a junction for commerce, and its connections from China Proper and Manchuria to the Trans-Siberian Railway. Harbin expanded from a small village to a city soon after 1898 when it became a junction for the Porth Arthur and Vladivostok lines of the CHINESE EASTERN RAILWAY. Impetus was given to its growth by the Russo-Japanese War when it was supply base for the Russian armies. Pop. 1929, 252,988.

HARBINGER-OF-SPRING (*Erigenia bulbosa*), a delicate early blooming wildflower of the parsley family found in low woods from Ontario to Minnesota and ranging southward to Alabama and Missouri. It is a very smooth, almost stemless perennial, which springs from a deep tuber, bearing much divided leaves and small clusters of white flowers.

HARBORD, JAMES GUTHRIE (1866-), American military officer, was born at Bloomington, Ill., Mar. 21, 1866. He graduated in 1886 from the Kansas State Agricultural College. In 1889 he joined the U.S. Army, serving as officer in both infantry and cavalry, and in 1903-14 being assistant chief in the Philippine constabulary. At the outbreak of the World War he was sent to France, being chief of staff of the A.E.F. from May, 1917, to May, 1918. From June to July, 1918, he commanded the Marine brigade at Château Thierry, which helped turn back the Germans from their drive on Paris, and commanded the 2d Division at Soissons, July, 1918. In May, 1919, he was re-appointed chief of staff of the A.E.F., and was deputy chief of staff of the U.S. Army July 1, 1921, to Dec. 29, 1922, when he retired from the Army and became president of the Radio Corporation of America.

HARBORS, natural or artificial havens or sheltered places for shipping. Harbor improvements consist of BREAKWATERS; entrance JETTIES; other training and protection works, such as SEA WALLS, BULKHEADS, GROINS; ANCHORAGE grounds; navigable CHANNELS; and aids to NAVIGATION. *See also* PORTS; WATERWAYS.

Harbor lines are limits set to protect harbors, or waterways, from encroachments of land or structures. A *pierhead line* is an outer limit set for ends of piers or other open or intermittent constructions; the *bulkhead line* is the set limit for bulkheads and solid fill.

F. R. H.

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HARBURG, a Prussian city across the Elbe from, and a suburb of HAMBURG. Its industries include the manufacture of India rubber, machines, chemicals, textiles and corn products. It has a flourishing trade with Hamburg and oversea ports, as the river is navigable for seagoing vessels. In the 12th century Harburg was a frontier fortress and belonged to the bishopric of Bremen. Pop. 1925, 73,212.

HARCOURT, SIR WILLIAM GEORGE GRANVILLE VENABLES VERNON (1827-1904), English statesman, was born at York, Oct. 14, 1827. He was educated at Cambridge, became a barrister in 1854 and a Queen's Counsel in 1866. His letters to the *Times,* defending English neutrality during the American Civil War, attracted attention. He entered parliament, 1868, was knighted 1873, and a staunch supporter of the Whigs, became leader of the Liberals, 1894-98. He opposed England's attitude in the Transvaal and ritualism in the Church of England. His death occurred Oct. 1, 1904.

HARDEN, MAXIMILIAN (1861-1927), German publicist and editor, whose real name was Witkowski, was born in Berlin, Oct. 20, 1861. He wrote chiefly

on political subjects for the journals. Harden founded *Die Zukunft* in 1892 and developed it into a highly successful periodical. After a violent attack on certain of the Emperor's courtiers in 1907 a libel suit ensued, in which Harden was acquitted, and his chief victim, Prince Philip Eulenberg, was forced to flee from Germany. During the World War he did not hesitate to criticize either the German Government or the German Army. Harden died Oct. 30, 1927.

HARDENBERG, FRIEDRICH VON. *See* NOVALIS.

HARDENBERG, KARL AUGUST VON (1750-1822), German prince, was born in Hanover May 31, 1750. At the accession of Frederick William III he became a member of the Prussian cabinet, then foreign minister and in 1810 chancellor. Hardenberg carried out Stein's plans for reform, for present emancipation, local government and for reorganization of the army. He also favored the throwing open of the civil service to all classes and the complete reform of the educational system. He died at Genoa Nov. 26, 1822.

HARDHACK (*Spiræa tomentosa*), a small shrub of the rose family, known also as steeple bush. It is found widely in open grounds in eastern North America, sometimes in pestiferous abundance in meadows and pastures; it is also often planted as an ornamental. The plant grows about 4 ft. high with reddish brown stems bearing sharply toothed leaves, which are yellowish or whitish woolly below, and a dense steeple-like spike of purple, pink or sometimes white flowers. *See* SPIRÆA.

HARDICANUTE or **HARTHACANUT** (1019-42), English king, son of King CANUTE, was born about 1019. When his father died, while Hardicanute was in Denmark, his half-brother, Harold, seized the throne and was crowned after civil strife in 1037. He made preparations to attack his brother to obtain the throne, but before his plans were carried into execution, Harold died. Hardicanute succeeded to the throne in 1040. He died June 8, 1042.

HARDIE, JAMES KEIR (1856-1915), British Labor leader, was born at Legbrannock, Lanarkshire, Aug. 15, 1856. When a young boy he went to work in the mines, where he continued until he was 24. He edited the first Socialist journal in western Scotland, the *Labor Leader,* which he had helped to establish in 1887. The following year he ran unsuccessfully for parliament, was elected in 1892, defeated in 1895, and again elected in 1900. He was one of the chief founders of the Scottish Labor Party (1888) and the Independent Labor Party (1893), and his work greatly aided the establishment of the British Labor Party in 1900. He wrote several books, traveled and lectured widely, and made a vain effort to weld the workers of different nations together in a stand against war. Grief at the outbreak of the World War undoubtedly hastened his death, which took place Sept. 26, 1915.

HARDING, CHESTER (1792-1866), American painter, was born in Conway, Mass., Sept. 1, 1792. After following various occupations, including that of innkeeper, he became a portrait painter. Going to London in 1832, he painted many distinguished Englishmen. On his return to the United States, he painted portraits of Washington Allston and John Randolph, now in the Corcoran Gallery, Washington, and of Daniel Webster, Gen. Sherman, Henry Clay, John C. Calhoun and Presidents Madison, Monroe and John Quincy Adams. Harding died Apr. 1, 1866.

HARDING, WARREN GAMALIEL (1865-1923), 29th President of the United States, was born at Corsica, Morrow Co., O., Nov. 2, 1865, the son of Dr. George Tyron Harding, a physician of English descent, and Phoebe Elizabeth Dickerson. Harding was the eldest of eight children, was brought up a Baptist, and spent his boyhood on his father's farm. He attended the rural district school until in 1879 he was sent to Ohio Central College at Iberia where he remained until 1882.

After leaving college Harding moved to Marion, O., fifty miles from Columbus, where he began working for the local weekly, the *Star,* assuming the editorship in 1884 and later buying the paper and converting it to a daily. The paper became very influential under Harding's able editorship, and its value increased with the growth of Marion, a town devoted to the manufacture of industrial and farm machinery. Harding retained the paper until shortly before his death. In the meantime shrewd investments in real estate and lumber had made Harding financially independent, and a growing friendship with Senator Joseph B. Foraker enabled him to enter politics as a Republican. He was elected to the State Senate in 1900 and remained in that body four years when he was elected Lieutenant Governor for a two-year term. In 1910 he was candidate for Governor, but was defeated. He remained regular in the Progressive movement of 1912. In the first popular election to the United States Senate under the 17th Amendment, Harding entered the Republican primaries against his former friend, Senator Foraker, carried them, and later carried the State at the regular election.

The most distinctive feature of Harding's activity in state politics was his party regularity, and nothing in his Senate career indicated any essential change in his conception of his political responsibilities. He accepted the more conservative Republican policies, approved preparedness, but not support of the eastern leaders in demanding war upon Germany, until this step in its turn became the policy of the regulars. With the rest of his party he supported the bulk of Wilson's war time measures, disapproving, however, of the food and fuel control. He voted to pass the Volstead act over Wilson's veto and supported the 18th Amendment.

Harding was a member of the Committee on Foreign Relations at the time of the submission of the Treaty of Versailles to the Senate, and although he opposed this treaty because of the inclusion of the League of Nations in it, he did not join either of

the two extremist groups, that of Borah and Johnson, or that of Lodge, in relentless opposition.

The nomination of Harding for the Presidency by the Republican National Convention of 1920 is a matter in which all the evidence has not yet been given. At the opening neither the delegates nor the public thought of such a thing. General Wood was considered the strongest candidate, but against him had been built up the candidature of Governor Lowden. When Lowden seemed on the point of himself gaining the nomination, however, a peculiar financial transaction of one of his delegates was rather curiously discovered and the Convention deadlocked. Apparently at this point Harry Daugherty proposed Harding's name to the contending leaders. Satisfactory arrangements in regard to presidential appointments were concluded, and suddenly in the tenth ballot Harding was nominated. The election in that year was a mere matter of form, for the desire of business to be rid of every vestige of Democratic war-time control, and the popular reaction against the artificial hysteria to which the people of the country had been stirred, furnished the Republican Party with a full campaign chest and an enthusiastic and uncritical electorate. The Democratic candidate, Governor Cox, met his expected defeat, the electoral vote being 404 for Harding and 127 for Cox.

Harding's career prior to his election as President had been that of hundreds of average politicians, but as President it became tragic. He was a genial, kindly man, tall, with a handsome face which seemed thoughtful and inspired confidence. He uncritically trusted his friends who in several instances shamefully betrayed that trust. As he himself said it seemed easy to be President and only at the very end of his life did he come to realize the terrific responsibility which might fall upon a President. Some of his cabinet appointments indicated the political combinations which had made possible his nomination. Charles E. Hughes, a man of reputation and with strong support in conservative circles, became Secretary of State; Andrew W. Mellon, the candidate of the great eastern financiers, Secretary of the Treasury; Herbert Hoover, perhaps equally acceptable in financial circles and possessed of a much wider popular fame, Secretary of Commerce. On the other hand Harding's friends received their appointments: Albert B. Fall, Secretary of the Interior; Edwin Denby, Secretary of the Navy; Harry Daugherty, Attorney General. Other appointments were largely dictated by local political conditions.

The administration began its career under most favorable circumstances. Business improved from the depression of the opening months of 1921, the Washington Conference, largely the work of Secretary Hughes, effected a limiting treaty among the naval powers and was widely applauded. Above all, the "back to normalcy" policy of Harding, the giving to business a free hand after the stringent restrictions of war time, met with approval from almost every element in the country. Harding rode with the tide, sure of himself, enjoying himself, looking forward to his reelection. But gradually difficulties accumulated. Friends he had trusted were shown to have betrayed him. An atmosphere of doubt, fear, and suspicion grew up in Washington as Congressional investigation of the Administration became more and more certain. Significant political personages disappeared by not always thoroughly explained deaths. It became apparent, though not established in court until later, that Secretary Fall had been bribed to turn over naval oil reserves to private interests, that the Attorney General's office was a maze of corruption, that the Veterans' Bureau and the Alien Property Custodian's office were not above suspicion. In the summer of 1923 with all this still known only to the insiders, but with the storm of Congressional investigation momentarily threatening to break, Harding, suddenly an old man, tired and haggard, started on a trip to Alaska. On his return he was taken ill and died unexpectedly at San Francisco, Aug. 2, 1923. The exact cause of his death has never been told. He was buried at Marion, where a memorial to him was dedicated in the summer of 1931 by President Hoover and ex-President Coolidge. Harding left an estate of approximately $500,000.

On July 8, 1891, Harding married Florence Kling De Wolfe, the daughter of a Marion hardware merchant, later a banker, and former wife of Henry De Wolfe, by whom she had a son, Marshall Eugene. The Hardings had no children. Mrs. Harding died at Marion, Nov. 21, 1924. L. Br.

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HARDING MEMORIAL, a memorial to President Warren G. Harding erected at Marion, Ohio, in 1926-27, at a cost of $800,000, subscribed by the public. It is an unroofed circular building 102 ft. in diameter and 57 ft. high, situated in a 10-acre landscaped park. The outer circumference consists of 24 great Doric columns, each containing 53 tons of marble. An inner circle, having 22 fluted Ionic columns, contains the graves of President and Mrs. Harding. On June 16, 1931, President Hoover accepted the memorial on behalf of the nation.

HARD MONEY, a term used in the United States in the discussions of the early '70s to describe the doctrines of those who favored a metallic basis for the currency system, as opposed to the doctrine of those who favored a paper basis or soft money or greenbacks which was the popular name for the United States notes in paper money issued in large quantities during the Civil War, and which were not redeemable in coin. In 1876 the GREENBACK PARTY was formed on a platform of continuation of the greenbacks and repeal of the Act of 1875 which provided for resumption of special payments in 1879. J. P. Y.

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HARDNESS TESTS. *See* BRINELL TEST; *also* ROCK TESTS.

HARD PAN, a word used in the United States to describe a layer of hard, intractable clay intermingled with sand and pebbles, which sometimes underlies surface soil. In glaciated regions, this is the more or less firmly compacted boulder clay, or *till* of the ground moraine. Excavations, or railway cuttings are carried through such detrital material, with almost as much difficulty as if it were solid rock.

HARDWARE, a term broadly covering articles made of metal but generally applied to tools, household utensils, and probably more specifically to hinges, locks, etc., used in building construction. Earliest hardware was made of hand wrought metal but with the development of the art of making metal castings in sand molds, the wrought metal was replaced with cast. Later developments of both hot and cold rolling, especially of ductile steels, introduced a cheaper and better material with the result that the greater part of builders' hardware is now made from rolled metal which is blanked into suitable shape and subsequently formed into the desired article. Where shapes which cannot be made from sheet metal are desired, it is necessary to use castings which are made either in sand, permanent metallic molds or by die casting, where the metal is forced into a permanent mold. Materials are principally steel, brass and bronze, although aluminum, zinc, and various nickel alloys are used. In many cases the steel hardware is electro-plated to give the appearance of brass, bronze or nickel. The use of the new stainless steels (*see* CHROMIUM STEEL) is making progress and will be more common as the cost becomes less. W. S. Ro.

HARDY, ALEXANDRE (1569?-1631), French dramatist, was born at Paris about 1569. He was engaged by a provincial theatrical troupe to provide them with new pieces. In this he was eminently successful, his entire output numbering about 700 plays, some written when he became accredited dramatist to the Marais Theatre. His psychology is poor and his writing mediocre, but he had a feeling for stage-effect, intrigue and plot. He probably died in 1631.

HARDY, ARTHUR SHERBURNE (1847-1930), American diplomat, mathematician and novelist, was born at Andover, Mass., Aug. 13, 1847. He was educated at the United States Military Academy, at Amherst College, and in Paris. From 1874-93 he was professor of civil engineering and mathematics at Dartmouth College; at this time he published a number of books on mathematics and several novels. In 1893 he became editor of the *Cosmopolitan Magazine.* From 1897 to 1906 he served as a diplomat abroad, his last appointment being that of Minister to Spain. Hardy's later novels included *Diane and Her Friends,* and *Helen,* 1916. His memoirs, *Things Remembered,* appeared in 1923. He died in Woodstock, Conn., Mar. 13, 1930.

HARDY, THOMAS (1840-1928), British novelist and poet, was born June 2, 1840, in Dorsetshire. He studied architecture and was successful in that profession, but after the publication of his first stories wavered for some years between architecture and literature, finally taking up the latter. During his first period of authorship he wrote novels, producing almost 20, of which some of the more important titles are *Far from the Madding Crowd, The Return of the Native,* TESS OF THE D'URBERVILLES, one of the great novels of the 19th century, and *Jude the Obscure.* Afterward he wrote no more fiction but devoted himself to his poetic drama *The Dynasts,* which many regard as his greatest achievement, an epic play in three parts appearing from 1904 to 1908. It deals with England's share in the Napoleonic wars, and parts of it have had stage production.

During his last 20 years Hardy wrote nothing but lyrics, of which six or more volumes have been published. In poetry and fiction he developed and mastered a technique instinct with his own individuality. His work exhibits tragic power, irony, sensitiveness to beauty, deep understanding of nature, and at its heart is always the struggle, usually unsuccessful, of the individual against his own nature and surroundings. A pessimistic realist, Hardy found life cruel, but, because he was healthy, he found it also fascinating. He watched dispassionately the stormy lives of his "Wessex" men and women, recording not only what any gifted reporter would have seen in those human struggles, but also the minutiae of background and circumstance which he alone could perceive. The Hardy picture is ironic, inevitable; it is life stripped of its rosy illusions. Thomas Hardy died Jan. 11, 1928, at his home, Max Gate, Dorchester, his heart being buried in the parish church, and his ashes in Westminster Abbey.

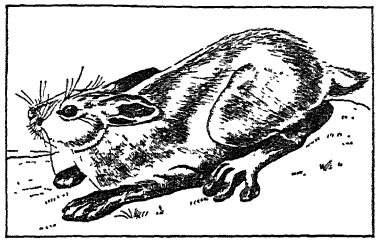
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HARE, SIR JOHN (1844-1921), English actor-manager, was born at London, May 16, 1844, and made his first stage appearance at the Prince of Wales Theatre, Liverpool, Sept. 28, 1864. He became noted by his performances in the T. W. Robertson comedies, and in such parts as Sir Peter Teazle in *The School for Scandal.* He became manager of the Court Theatre, 1875, the St. James's, with W. H. Kendal, and the Garrick which he opened in 1889. Among his best known rôles were Colonel Daunt in *Queen's Shilling,* Duke of St. Olpherts in *The Notorious Mrs. Ebbsmith,* Goldsmith in *A Pair of Spectacles* and Lord Quex in Pinero's play of the same name. He died Dec. 28, 1921.

HARE, a rabbit-like mammal, widely distributed through Europe, Asia, Africa and North America. North American species include the varying hares (*Lepus americanus*), also called snowshoe rabbits; arctic hares (*L. arcticus*); white-tailed jack rabbits (*L. townsendii*), and black-tailed jack rabbits (*L. californicus*). Hares differ from rabbits in their larger size, longer hind legs, longer ears and larger feet. Young rabbits are born naked in burrows, while hares nest in shallow, open depressions, where two to four young are born covered with hair.

Varying hares, of which there are several subspecies,

are found throughout Canada and in the northern border of the United States and southward in the higher mountains. The brownish color changes to white in winter, due to a molting of the summer fur. Their broad hind feet, which suggested the name of snowshoe, permit them to travel rapidly over soft snow. The arctic hare groups occur only north of the tree limit in Canada and Alaska. The black-tailed jack rabbits, the best known of the hare family in



NORTHERN HARE

the western United States, are noted for their high-bounding, rapid gait, which enables them to outrun coyotes and all dogs except the finest greyhounds. In some localities, they are systematically hunted because of the damage they inflict on crops. They differ from the white-tailed jack rabbit in the broad black stripe down the back and the tail is gray and black instead of white. A. R. F.

HARE or **KAWCHODINNE,** a North American Indian tribe of the Northern Athapascan linguistic stock. They live peaceably in Canada, in contact with the Eskimo, to the north of Great Bear Lake, on the Mackenzie River, and the lakes to the east and on the Anderson River. Like all the Northern Athapascan peoples, they are hunters and trappers. They have so long been in contact with whites, particularly traders, that they have lost most of their aboriginal customs.

HAREBELL (*Campanula rotundifolia*), a delicate perennial of the bell-flower family also known as the bluebell of Scotland. The plant is found widely throughout the north temperate zone being especially abundant in roadsides and pastures in the British Isles. In North America the harebell grows in moist places from Labrador to Hudson Bay and Alaska, ranging southward in the mountains to Arizona and California. The slender erect stem, rising from a creeping rootstock, bears roundish heart-shaped, long-stalked root leaves, very narrow stem leaves and beautiful blue drooping flowers in an open panicle.

HAREM, more exactly harim, an Arabic word used in the Moslem Near East with special reference to the women's quarters in the Moslem home. It may refer, as well, to the women themselves, especially the wives, of the household. Zanana is the familiar term used in India as the equivalent of harim. The word harim means primarily a holy place (*haram*), or something taboo, or sacred (*hurum*). Mecca and Medina are *al-haramain,* the two holy cities.

Mohammed adopted from without and enjoined upon Moslems the policy of the seclusion of women. The veil became, also, the sign of the virtuous woman. The new woman in Moslem lands is laying the veil aside and renouncing the harem, so long as this may be done with due decorum.

HARES-FOOT FERN (*Polypodium aureum*), a stout highly ornamental plant of the true-fern family native to tropical America, widely grown for its handsome glaucous-blue foliage. The large, deeply lobed fronds, 2 to 4 ft. tall and a foot or more broad, rise from scaly rootstocks which cling to the surface of the pot or tree supporting the plant. There are numerous foliage varieties in cultivation.

HARGREAVES, JAMES (?-1778), English inventor, was born probably at Blackburn, and became a carpenter and weaver at Stanhill. He built an improved carding machine in 1760 and in 1764 invented the spinning jenny with which he could spin, using several spindles at one time. His competitors resented this advantage and in 1768 broke into his house and destroyed his machinery, after which he erected a spinning mill at Nottingham. In 1770 he obtained a patent on his invention but it was later proved invalid because he had sold models prior to the obtaining of the patent. He died in Nottingham in April 1778.

HARIZI, JUDAH BEN SOLOMON (Judah Alharizi) (13th century), noted Hebrew poet and translator, and one of the last of the Golden Age in Spain, flourished about the first half of the 13th century in Granada, Spain. Almost nothing is known of his life, except that he came to Palestine in 1216, and was in Jerusalem in 1218; later he journeyed through Egypt, Greece and Mesopotamia, and was well-versed in both Hebrew and Arabic.

Harizi translated into Hebrew, under the title of *Mahberoth Itiel,* the renowned Makama poetry of the Arabic poet Hariri of Bozra (Bazra). He translated also a part of Maimonides's *Commentary on the Mishna* and the whole of his *Moreh Nebuchim* into Hebrew, as well as a number of less important works by various authors. He himself was the author of a satirical, poetical novel, in Hebrew, called *Tahkemoni,* or *The Wise One,* which he composed as a counterpart to the Makama of Hariri of Bozra. It was his masterpiece, and in it he displayed great originality of thought and great artistic and stylistic skill. In the *Tahkemoni* Harizi wittily portrayed his own experiences in life and the glaring defects of his own times. Like the model of Hariri, Harizi employed the same peculiar form of rhyming prose.

A. Sh.

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HARKNESS, ALBERT (1822-1907), American classical scholar, was born at Mendon, Mass., Oct. 6, 1822. He graduated at Brown University in 1842 and later studied at Berlin, Bonn and Göttingen. Beginning in 1855, he was for 37 years Professor of

Greek at Brown University, and in 1892, became Professor Emeritus. His *Latin Grammar* and editions of Latin school-readers were widely used in teaching. Harkness died in Providence, R.I., May 27, 1907.

HARLAN, JOHN MARSHALL (1833-1911), American jurist, was born in Boyle Co., Ky., June 1, 1833. He practised law at Frankfort and Louisville, Ky., and served in the Civil War as a colonel in the Union army. During 1863-67 Harlan held office as attorney-general of Kentucky. In 1877 he was appointed associate justice of the United States Supreme Court and in his thirty-four years of service was known for his independence and championship of popular rights. President Hayes appointed him to the Louisiana Commission in 1877 and in 1893 he was a member of the Bering Sea Arbitration Tribunal. He died at Washington, D.C., Oct. 14, 1911.

HARLEM, a part of New York City, the northern part of Manhattan Island, above 106th Street, between Eighth Avenue and the Harlem and East rivers. Harlem is now largely a Negro district, the most intensively populated Negro section in the world. The site which at present is Mount Morris Park was settled in 1636. An attractive little Dutch village grew up which Peter Stuyvesant named New Harlem after Haarlem, the home of the colonists from Holland. In the Battle of HARLEM HEIGHTS the American forces put the British to flight, Sept. 16, 1776. An account of the growth of Harlem into a Negro community is contained in James Weldon Johnson's *Black Manhattan.*

HARLEM HEIGHTS, BATTLE OF, Sept. 16, 1776, an engagement of the REVOLUTIONARY WAR which resulted in an American victory. After the BATTLE OF LONG ISLAND, Gen. Washington reinforced his position on Brooklyn Heights in the hope that Gen. Howe would make an immediate attack by storm, before favorable winds should permit the British fleet to enter the East River and make the occupation of New York by the Continental army impossible. But when Howe settled for a siege Washington directed a retreat, on the night of Aug. 29, across the river to New York. His army then occupied Harlem Heights, near the present site of Columbia University. Howe, with 25,000 British and Hessians, attacked this position; but Washington with an army of 12,000 repulsed the attack. The British lost 22 men, the Americans 15.

HARLEM SHIP CANAL, the stretch of improved waterway between the boroughs of Manhattan and the Bronx in New York City. Between 1895 and 1913 the Federal and state governments dredged a link connecting the Harlem River, emptying into the East River, with Spuyten Duyvil Creek, a smaller stream further north emptying into the Hudson River. The resultant waterway provided a short route between the Hudson and East rivers. The ship channel together with the Harlem and Spuyten Duyvil links forms a waterway between 150 and 400 ft. wide, with a depth of 15 ft. at mean low water, and a length of 8 mi., extending south by east from the Hudson to the mouth of the Harlem River opposite Randall's Island. The project cost $3,550,000.

HARLEY, ROBERT (1661-1724), Earl of Oxford, was born in London, Dec. 5, 1661 After Queen Anne's accession, he, and Bolingbroke, became the leaders of the Tories. His tenure of office was remarkable for intrigue, and toward the end he was impeached and imprisoned for a time. Pope and Swift have extolled his character. The books and MSS. which he collected were among the wonders of his day, and are now in the British Museum. He died May 21, 1724.

HARLINGEN, a city in Cameron Co., southernmost Texas, situated 275 mi. south of San Antonio, on the Colorado Arroyo River. Two railroads, air and bus lines serve the city. Cotton, citrus and vegetables are raised in the district. Cotton-seed products are the chief manufactures; a Mexican palm hat plant and a concrete tile manufacturing plant are also located here. The retail trade in 1929 amounted to $6,399,321. The city is the concentration point for shipping fruit and vegetables from the vicinity. It was founded in 1904 and incorporated in 1910. Pop. 1920, 1,784; 1930, 12,124.

HARLOWE, CLARISSA. *See* CLARISSA HARLOWE.

HARMONIC ANALYSIS, the breaking up of a complex wave form into simple harmonic components. The simplest type of vibration which a particle can have is called simple harmonic motion, a to and fro motion about a central position under the action of a restoring force which is proportional to the displacement. The prongs of a freely vibrating TUNING FORK have a simple harmonic motion. The trace of such a motion on a film moving at right angles to this motion is a sine curve, as shown in Fig. 1. FOURIER first proved, in 1822, that any

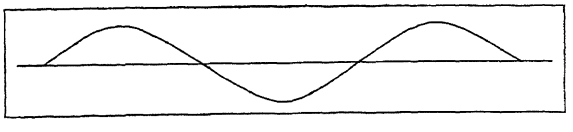


FIG. 1. SINE CURVE TRACE OF A SIMPLE HARMONIC MOTION

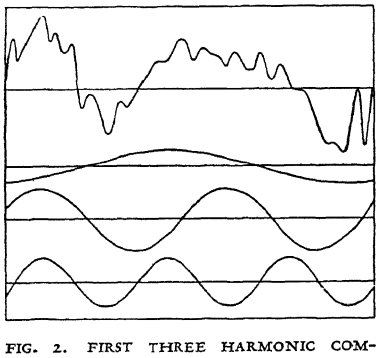


FIG. 2. FIRST THREE HARMONIC COMPONENTS OF THE VOWEL SOUND ō

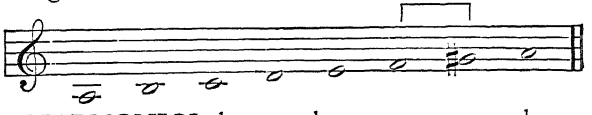
periodic curve, having a WAVE-LENGTH, *L*, can always be reproduced by compounding sine curves of suitable AMPLITUDES and PHASES, having wave-lengths of 1, ½, ⅓, ¼ and successive aliquot parts of *L*. Expressed in terms of SOUND waves, any complex musical tone may be resolved into a series of pure tones, simple harmonic tones, whose frequencies bear the relations of the numerical series 1, 2, 3, 4 . . . . . See Fig. 2.

Harmonic analyses may be made mathematically, but the process is long and tedious. Various mechanical means of doing this work have been developed, the best known being that invented by Henrici in 1895. *See* MATHEMATICAL INSTRUMENTS.

Many problems in physics, astronomy, meteorology and statistical economics can be treated by the method of harmonic analysis. P. E. S.

HARMONIC LAW, of Kepler, a relation between periodic time of revolution and distance of planets and comets from the sun. It is generally applicable to all stellar systems.

HARMONIC MINOR SCALE, as opposed to the MELODIC MINOR SCALE, one of the two forms of the minor MODE distinguished by the interval of the augmented second in both the ascending and descending forms. This interval invariably occurs between the sixth and seventh degrees and is indicated in the following model, the harmonic minor scale based on A being used for the illustration:



HARMONICS, known also as overtones and partials, secondary tones produced by the vibration of a sounding body in segments. Artificial harmonics are produced by the performer by appropriate manipulation of his instrument. On the violin, where they are most familiar, they are produced by touching the string lightly and so damping the vibration of the whole string that it vibrates in segments. According to the position of the finger, the length of the pulsating portion of the string is altered; and this secondary pulsation, more and more rapid in direct ratio to the shortening of the string, yields a tone whose pitch is raised in direct ratio to the frequency of the vibrations. The quality is ethereal and flute-like.

Natural harmonics are produced without any intervention of the performer and are indispensable to the tone-color of various instruments whose characteristic tonal quality is caused by the relative intensity of the members of the harmonic series. Freely vibrating strings and air columns produce harmonics, but the overtones of vibrating reeds, bars, diaphragms and bells are in general, not harmonics. *See also* HARMONIC ANALYSIS.

HARMONY, in music, has two meanings, one popular, the other technical. The popular definition of harmony is a concord; the technical definition includes discords of every degree as well as concords. Any combination of tones whatsoever is technically a harmony, therefore, whether the combination is pleasant or unpleasant. The art, science and study of harmony thus concern themselves with all possible combinations of tones sounded simultaneously.

1. As an art, harmony is relatively modern, having failed to reach any great degree of development before the 16th century, and having failed to reach maturity before the 18th century. Despite the great interest which the Greeks showed in certain theoretical aspects of music (*see* MUSIC: *Greek*), they had little if any interest in harmony. Their music, like that of the older Egyptian, Chinese, and Babylonian civilizations, was almost entirely melodic. Indeed, nowhere throughout the world was the art of harmony practised to any important degree until the end of the Middle Ages. Giuseppe Zarlino's *Le Istituzione harmoniche,* published in 1558, during the lifetime of PALESTRINA, is one of the earliest known treatises on harmony, and more than a century was to elapse before JEAN PHILIPPE RAMEAU'S *Treatise on Harmony Reduced to Its Natural Principles,* published in 1722, brought together a mass of scattered opinions on the subject. Difficult though it is for the modern musician to realize, harmony as an independent art has had an exceedingly short history. The augmented fifth, for example, was apparently first used by Luca Marenzio in 1593, and the diminished seventh made its début in CLAUDIO MONTEVERDE'S opera, *Il Ballo delle ingrate,* produced in 1608. Since then the art of harmony has developed rapidly, especially in the field of dissonance in which composers, beginning about 1880, have allowed few discords to remain unturned (*see* ATONALITY; DISCORD). On the other hand, the most important features of the art were elaborated between 1600 and 1750, so that subsequent features must be regarded as novelties laid upon a classical framework rather than as genuinely new or radically important inventions.

2. As a science, harmony is fairly venerable in certain respects, but in others is also comparatively modern. The logical or mathematical basis of harmony may be traced back to the Greek philosopher PYTHAGORAS, in the 6th century B.C., who first discovered that all the elements of the musical scale could be defined as ratios between the lengths of a single string in vibration. It was he who first discovered, or at least enunciated, this important scientific feature of harmony. The discovery that exactly half a given string produced a tone exactly one octave higher than the whole string, and that two-thirds and three-quarters of the string produced two other concordant intervals or harmonies, the fifth and the fourth, respectively, was a fact of great significance, not only in serving as the scientific basis of the three most important intervals in music, but also as the foundation of all the smaller intervals comprised within the octave. Moreover, later Greek philosophers and mathematicians, notably Aristoxenos (fl. 325 B.C.), Eratosthenes (276-195 B.C.), Euclid (c. 300 B.C.), Didymos (b. 63 B.C.), and Claudius Ptolemy (fl. 100 A.D.) actively concerned themselves with a study of Pythagorean principles, in some instances improv-

ing on their master's utterance. On the other hand, the corresponding inverse ratios between the number of air-waves generated by vibrating bodies was not to be discovered for many centuries; and while, as long ago as 1636, Marie Mersenne, the French monk and musicographer, published his *Harmonie universelle,* which discusses harmonic tones, or partials, nothing was then known of the compound vibration of a string which is responsible for the production of natural harmonics. Ernst Chladni in the following century made further important contributions; but it was only with HERMANN HELMHOLTZ (1821-94) that a thorough and scientific analysis of the reason for the discord of some intervals, and for the consonance of others, was elaborated. In fine, then, the science of harmony is also a comparatively modern branch of acoustics.

3. The study of harmony as discipline imposed upon aspiring composers is also a relatively recent activity. Briefly defined, it is the grouping of four separate parts, called voices, into concords and dissonances. The general end in view is two-fold: first, to secure the maximum harmonic variety by means of the minimum motion of four voices, and, secondly, to train the ear to analyze the total effect into the motion of the four voices which produce it. It is, in many respects, the most important branch of musical theory, and precedes the study of COUNTERPOINT. Among its important features are the construction of the scale and the TRIAD, the principles of INVERSION and SUSPENSION, and, of course, the terminology of musical NOTATION in general which includes INTERVAL, STAFF, SIGNATURE, and CLEF.

BIBLIOGRAPHY.—H. E. Parkhurst, *Complete System of Harmony,* 1908; G. Dyson, *The New Music;* W. Parkhurst, *Anatomy of Music,* 1930.

HARMONY SOCIETY, a religious, communistic sect established in the United States in 1804, which disappeared early in the 20th century. 600 members, the main body of the sect, often called Rappists after the founder, George Rapp, emigrated from Wurtemberg, Germany, because of religious persecution, and established the settlement of Harmony in Lycoming Co., Pa. In 1814 the community removed to Posey Co., Ind., and received large additions from Germany; this second site was sold to ROBERT OWEN in 1824, and the Harmony Society made its final settlement at Economy, Pa. The settlement was conspicuous among communistic experiments for its comparative prosperity; its members were estimated to possess $500,000 in surplus capital in 1860. Because of its religious requirement of celibacy, the society was not perpetuated.

HARMSWORTH, ALFRED CHARLES WILLIAM. *See* NORTHCLIFFE, ALFRED CHARLES WILLIAM HARMSWORTH, LORD.

HARNACK, ADOLF VON (1851-1930), German theologian and writer, son of a well-known professor of theology, was born at Dorpat, Estonia, May 1, 1851. He occupied the chair of theology successively at Leipzig (1876), Giessen (1879), Marburg (1886) and Berlin (1889-1924), and was also director general of the Prussian State Library (1905-21). In the Evangelical-Social Congress (1902-21), he served as chairman. He was a leader of the Lutheran liberal theologians, and his most important work *Lehrbuch der Dogmatengeschichte* (1886), was epoch-making and influential. Harnack was a prolific writer and a deep thinker who upheld the cause of open-mindedness in Bible study. He died June 10, 1930.

HAROLD I (?-1040), English King, was believed to be the illegitimate son of CANUTE. While HARDICANUTE, his brother, was in Denmark, upon the death of King Canute in 1035, Harold claimed the English crown, and after civil conflict was crowned in 1037. After a reign of three years Harold died at Oxford, in 1040.

HAROLD II (1022-66), English King, the last of the Saxon Kings, was born in 1022. When EDWARD THE CONFESSOR died in 1066 his power and prestige as chief minister of the king caused him to be elected and crowned as Edward's successor. His right to the throne was disputed by his brother Tostig and also by William of Normandy (*see* WILLIAM I). In the battle of Stamford Bridge, Harold defeated Tostig and his ally, the King of Norway. But when he engaged forces with William at Hastings, Harold was outmaneuvered and killed on Oct. 14, 1066. *See* HASTINGS, BATTLE OF.

HAROLD I (850-933), first King of Norway, fell heir to the rule of several disorganized kingdoms of southeastern Norway about the year 860. Shortly after his accession, about 866, he initiated a military campaign which resulted in the conquest of all Norway. His reign is notable for the large number of new colonies founded by exiles from the conquered sections. The consolidation of disunited kingdoms, however, had no permanent effect as the country was divided among Harold's sons upon his death in 933.

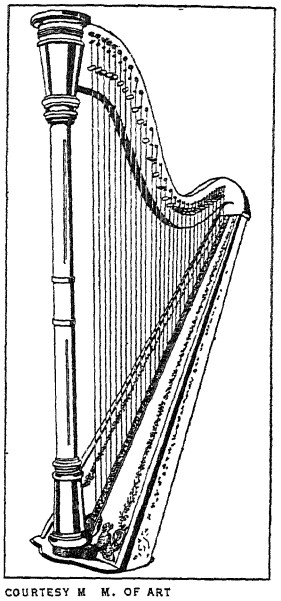
HAROLD III (1015-1066), King of Norway, a descendent of Harold I. Forced to flee from the country in 1030 after the battle of Stiklestad, he served at Constantinople as a captain in the Greek Varangian guard. Falling into disfavor, he was obliged to leave Greece in 1042. Then, after a temporary alliance with Sven of Denmark against Magnus, King of Norway, he made peace with Magnus receiving half of the kingdom. In 1047, on the death of Magnus, he became king of Norway. He waged successful warfare against Denmark for several years but finally concluded peace. Invading England in 1066, he was successful for a time but was killed in the battle of Stamford, Sept. 25, 1066.



ANCIENT EGYPTIAN HARP PLAYED BY A DANCING GIRL

HARP, a stringed musical instrument of great antiquity, having been used in ancient Egypt and frequently mentioned in the Bible. It is the only sur-

vivor among plucked stringed instruments which has taken a secure place in the modern orchestra. Its modern form and mechanism were established by Sebastien Erard during the first quarter of the 19th century when the first "double action" harp was made; this, unlike the "single action" harp of the preceding century, permits the shortening of any string (by the action of a pedal) so that it produces a tone either a minor second or a major second higher than the normal one. It is furnished with 47 strings, having a compass of 6½ octaves, and 7 pedals by which the pitch of the strings throughout may be raised simultaneously in the manner mentioned. It is designed primarily for harmonic music, and is especially effective in producing "broken" chords—hence the word arpeggio; but in the hands of a skilled performer chromatic passages may be produced with some effectiveness. To meet the chromatic difficulty, the chromatic harp, having a separate string for each degree of the chromatic scale, has found some favor; however, owing to the multiplicity of the strings, it is generally deemed cumbersome by most composers. In consequence, the double-action harp described above is the one usually written for and employed in modern production.



COURTESY M M. OF ART

LATE 19TH CENTURY HARP, MADE BY MORLY OF LONDON

HARPER, WILLIAM RAINEY (1856-1906), American educator and Hebrew scholar, was born at New Concord, O., July 26, 1856. He graduated from Muskingum College in 1870, when he was only 14, and received his Ph.D. at Yale University in 1875. From 1875-76 Harper taught in Masonic College, Macon, Tenn., and from 1876-79 in the preparatory school of Denison University, Granville, O. His interest in Hebrew began when he was at Muskingum College, and after graduation he continued his study of Hebrew and other languages with a professor of the college. In 1879 he was appointed professor of Hebrew at the Baptist Union Theological Seminary, Chicago, where he conceived the idea and worked out a method of teaching Hebrew by correspondence, which gave him an international reputation. Harper also opened several Hebrew summer schools, including in the curriculum the interpretation and theology of the Old and New Testament. From 1883-95 he was one of the leaders at Chautauqua, and regularly gave a course in Hebrew at the School of Languages. He was professor of Semitic languages at Yale from 1886-91.

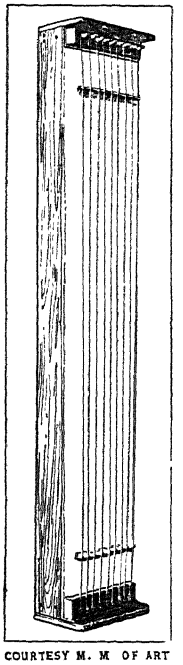
In 1891 Harper was prevailed upon to accept the presidency of the University of Chicago, in which he had had an important part in planning. He was also appointed head of the Semitic language department. Here he was able to work out unhampered his conception of what a real university should be, and introduced many innovations which have since been very generally adopted by other universities. Even during his presidency, which he held until death, he found time to write extensively for educational and popular magazines. Harper died in Chicago, Ill., Jan. 10, 1906.

Among his works are *Elements of Hebrew,* 20th ed., 1902; *Religion and the Higher Life,* 1904; and *The Trend in Higher Education,* 1905. M. R.

See T. W. Goodspeed, *William Rainey Harper,* 1928.

HARPER'S FERRY, a town in Jefferson county, northeastern West Virginia, situated at the juncture of the Potomac and Shenandoah Rivers. It is served by the Baltimore and Ohio Railroad. The town was the site of JOHN BROWN'S RAID in 1859 which stimulated the bitter feelings between the abolitionist and slavery groups. During the Civil War it was the scene of several engagements between Confederate and Federal forces. It was captured with 12,500 prisoners by Stonewall Jackson in 1862. Pop. 1920, 713; 1930, 705.

HARPIES or **HARPYIAE,** in Greek mythology, daughters of Thaumas and Electra, personified winds or windstorms which carried away people in sudden death. In Homer there is only one Harpy, the mother of Achilles's horses. They have been represented as winged goddesses, but are best known as creatures of evil intent, half maid and half bird. During the expedition of the Argonauts they were sent to plague blind Phineus by defiling and snatching away his food, but were finally driven off by the winged sons of Boreas.



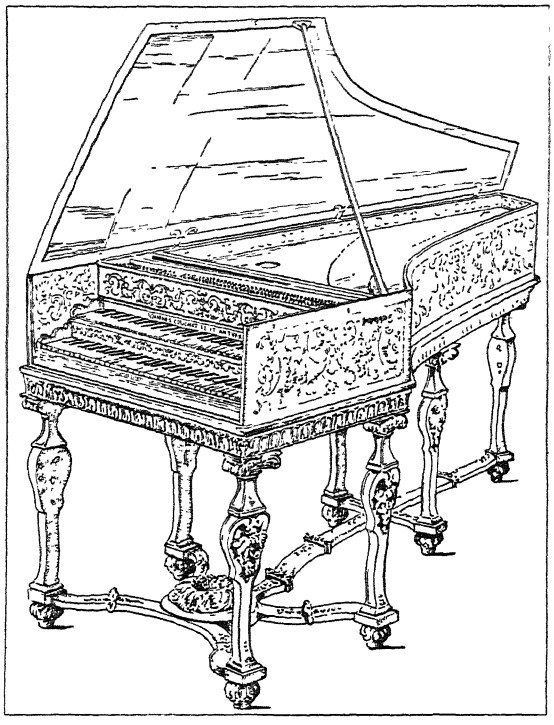
COURTESY M. M OF ART

AEOLIAN HARP OF 19TH CENTURY ENGLAND

HARP SHELL, the common name for a family (*Harpidae*) of sea snails, or shell-bearing marine gastropods. There are only nine species of harp shell, all of which live in deep tropical waters and frequent sandy or muddy places. These sea snails have very beautiful shells, brilliantly colored, shaped somewhat like harps, and showing ridges that suggest the harp's strings. The part of the shell which forms the harp is really the last whorl, which is extremely large in comparison with the spiral above it. The shells are greatly prized by collectors, but they cannot be kept on display owing to their tendency to fade if exposed to the light.

HARPSICHORD, a stringed musical instrument especially popular between the 16th and 18th centuries, and the forerunner of the pianoforte, which

it resembled in construction. In principle, however, it was different since the strings were plucked with quills instead of hammered. Little variation in volume was possible, and two keyboards were therefore common, one governing one set of quills, the second another set, either larger or made of different material. The spinet and virginal were small harpsichords without legs that were placed on a table. The clavichord, it is worthy of remark, differed from both the harpsichord and the pianoforte in one salient mechanical feature, namely, the hammer-action setting the strings in vibration. At the end of each key was affixed a small brass plate called a tangent which was driven against the string, causing it to vibrate, and which was simultaneously pressed against the string, thus determining the length of the vibrating segment. Accordingly, a single string served to produce tones of various pitch, according to the position of the tangent.



FROM M. M OF ART PHOTO

HARPSICHORD MADE BY JOANNES COUCHET ABOUT 1650

HARPY (*Thrasaëtus harpyia*), one of the largest and most powerful birds of prey, closely related to the eagles. This bird, which frequents dense forests from Mexico to Bolivia and Paraguay, exceeds 3 ft. in length, and has a wing spread of about 7 ft. It has a very strong beak, exceedingly large legs and feet, rather short wings, head with a conspicuously bifurcated crest and a long tail. The harpy's great strength enables it to cope with vigorous prey, including various mammals, as monkeys, foxes and peccaries. It builds a large nest in a high tree or upon a cliff. The harpy takes its name from the winged monsters of Greek mythology sent by the gods to execute vengeance.

HARRADEN, BEATRICE (1864-), English novelist, was born at Hampstead, Jan. 24, 1864. She attended Cheltenham, Queens, and Bedford Colleges, graduating at the University of London. The book which made her famous, *Ships that Pass in the Night,* appeared in 1893. Among her other novels are *In Varying Moods, The Fowler* and *Katharine Frensham.*

HARRAR, a town in southeastern Abyssinia, Africa, in 9° 18′ N. lat. and 42° 43′ E. long. Situated on a fertile tableland, producing coffee and bananas, 6,000 ft. above sea-level, it is the capital of a province bearing the same name. A substantial wall encloses the town. Commercially and strategically, it is of great significance since it commands the caravan routes to Berbera and Zeila. A railway connects the town with Jibutil and telegraph and telephone put it in close touch with Addis Ababa. A brisk traffic in tobacco, fruits and camels is carried on. Pop. 40,000.

HARRIER, a genus (*Circus*) of slender, medium-sized hawks frequenting meadows and marshes widely throughout the world. There are about 17 species, all less than 2 ft. long, with somewhat owl-like facial disks, the males usually gray and females brown in coloration. They nest on the ground laying usually 4 to 6 plain bluish-white eggs. Often flying very low they beat slowly back and forth over low grounds in search of the insects, snakes, small birds and mammals upon which they feed. Among the best known species are the North American marsh harrier or marsh hawk (*C. hudsonius*), ranging almost throughout the continent, and the hen harrier (*C. cyaneus*) found widely in Europe and Asia. *See also* HAWK.

HARRIMAN, EDWARD HENRY (1848-1909), American financier, was born Feb. 25, 1848 at Hempstead, L.I. At 14 years of age he was a stock broker's clerk. In 1870 he purchased a seat on the New York stock exchange, and two years later he founded the Harriman & Company, bankers. In 1883 he became a director of the Illinois Central Railroad. Harriman later acquired control of the Union Pacific and other lines, which gave him an unobstructed road from Chicago to the Pacific. His contest (1901) with James J. Hill caused a serious stock exchange panic, and later resulted in an investigation of the Harriman interests by the Interstate Commerce Commission. His financial methods provoked strong criticism, notably by Theodore Roosevelt, at one time his friend. He died at Turner, N.Y., Sept. 9, 1909.

HARRIS, FRANK (1856-1931), Anglo-American author, was born in Galway, Ireland, in 1856. He was educated in American and European universities, practiced law for a short time in Kansas, and held various editorial positions on London reviews. The best known of his writings include *The Bomb,* a novel based on the Chicago labor troubles of 1885-86, *The Yellow Ticket, The Man Shakespeare, Oscar Wilde, His Life and Confessions, Contemporary*

Portraits, and *Bernard Shaw, An Unauthorized Biography,* 1931. Harris died at Nice, France, Aug. 26, 1931.

HARRIS, FRANKLIN STEWART (1884-), American educator, was born at Benjamin, Utah, Aug. 29, 1884. He studied at Brigham Young University, at Cornell University, and in Europe and the Orient. From 1911-16 he was professor of agronomy and director of the Agricultural Engineering School at Utah Agricultural College. Harris was director of the Utah Experiment Station from 1916-21 and in the latter year became president of Brigham Young University. He wrote *Principles of Agronomy,* 1915; *Soil Alkali,* 1920; *Scientific Research and Human Welfare,* 1924, and *The Fruits of Mormonism,* 1925.

HARRIS, JOEL CHANDLER (1848-1908), American author, born at Eatonton, Ga., Dec. 8, 1848. He was a printer's boy at 12 in the office of *The Countryman.* The boy read much and mingled with the Negroes, laying the foundation for his future work. The appearance of *Uncle Remus* in 1880 was a literary event. *Nights With Uncle Remus* followed in 1883; among other works are *Mingo and Other Sketches* and *Daddy Jake, the Runaway.* Joel Chandler Harris was the first American writer to capture the real flavor of Negro folklore. The author died at Atlanta, Ga., July 3, 1908.

BIBLIOGRAPHY.—J. C. Harris, *Life and Letters of Joel Chandler Harris,* 1918.

HARRIS, TOWNSEND (1804-78), American diplomat and merchant, was born at Sandy Hill, N.Y., Oct. 3, 1804. At the age of 14 he became a drug clerk in New York City, soon rising to become a partner and a man of considerable fortune. He early devoted himself to educational and philanthropic interests, serving as a member and later as President of the Board of Education and being instrumental in the founding of the College of the City of New York and the Society for the Prevention of Cruelty to Animals. A voyage to the South Pacific in 1848 awakened his interest in the Far East and in 1854 he became Consul at Ningpo. Two years later he concluded a treaty with Siam, and then being appointed Minister to Japan, he resided at Kakisaki. He later went to Tokyo where despite the assassination of his interpreter he remained after all other western ministers had left and concluded the first Japanese trade treaty in 1858. On the election of President Lincoln he resigned his post and returned to New York where he died Feb. 25, 1878.

HARRIS, WILLIAM TORREY (1835-1909), American educator and philosopher, was born at Killingly, Conn., Sept. 10, 1835. He studied at Yale University for two years and then went to St. Louis, Mo., where he met students of German modern philosophy and became deeply interested in the teachings of Kant and Hegel. This study he continued all his life. From 1857-58 Harris taught in Franklin school and from 1858-67 was principal of Clay school, both in St. Louis. In 1867 he was appointed assistant superintendent and later city superintendent of the St. Louis public schools, holding the latter office until 1880. In 1873 Harris, with the assistance of Miss Susan Blow, made the kindergarten a part of the public school system of St. Louis, the first city in the United States to take this step. He exerted considerable influence in revising the courses in elementary schools throughout the country. From 1889-1906 he was United States Commissioner of Education. He wrote extensively for educational journals and contributed many articles to *The Journal of Speculative Philosophy,* which he founded in 1867, partly to acquaint Americans with Greek and German philosophy and in part to refute the philosophical theories of Herbert Spencer which were gaining foothold in America. Harris died at Providence, R.I., Nov. 5, 1909.

Among his writings are *Introduction to the Study of Philosophy,* 1889; *Hegel's Logic: A Critical Exposition,* 1890; *Psychologic Foundations of Education,* 1898. He was editor-in-chief of Webster's New International Dictionary.

HARRISBURG, a city of southwestern Illinois, and county seat of Saline Co., on the Saline River, 70 mi. northeast of Cairo. The Big Four route and an electric railroad serve the city. Agriculture and dairying are carried on in the vicinity which has extensive coal mines and a limestone quarry. Harrisburg has flour mills, sawmills and brickyards. In 1929 the retail trade amounted to $4,688,622. The place was settled about 1840, incorporated in 1876, and has been governed under the commission system since 1913. Pop. 1920, 7,125; 1930, 11,625.

HARRISBURG, the capital of Pennsylvania, a commercial city in the southeastern part of the state and the county seat of Dauphin Co. It is situated on the Susquehanna River, 105 mi. west of Philadelphia and is served by bus and truck lines and has the classification yards of the Pennsylvania and Reading systems. The beauty of the river, 1 mi. wide at this point, has been enhanced by development of a park with a bathing beach and pleasure boats and by the "front steps" which lead into the river basin. The city is almost surrounded by parks. The beautiful new state capitol is crowned with a dome copied from St. Peter's in Rome. An outstanding sight of Harrisburg is the half-mile long Soldiers' and Sailors' Memorial Bridge at the east end of the capitol. The principal manufactures are iron and steel, food products, hosiery and textiles, bookkeeping and accounting machines and boots and shoes. The factory output for 1929 was worth about $41,000,000; the retail trade amounted to $57,874,320. Iron and coal are found in the vicinity, and coal, seeped from hard coal mines, also is dredged from the bottom of the river. The city was founded in 1785 by John Harris, who operated a ferry at this point; it was chartered in 1860. In 1901 an immense bond issue was floated for the consolidation of municipal improvements, including new water supply, sewage, street, school and park systems; $14,000,000 have been put into the civic improvements since then. Pop. 1920, 75,917; 1930, 80,339.

HARRISON, BENJAMIN (1833-1901), twenty-third President of the United States, born at North Bend, Ohio, Aug. 20, 1833. He was a grandson of William Henry Harrison, ninth president. His parents were John Scott Harrison, Whig Congressman, and Elizabeth Irwin Harrison, both of English descent. The farm created out of the wilderness by his grandfather was his boyhood home. He attended the neighborhood school, held in a log-cabin, and later did some studying under a tutor. Two years were spent at a small institution called Farmers College, near Cincinnati, after which he entered Miami University, graduating in 1852. The next year Harrison studied law in Cincinnati and became a member of the bar. The same year Caroline Lavinia Scott became his wife, and he began a law practice in Indianapolis, Ind. Early recognition of his legal ability came in his election, at the age of 26, as reporter of the Indiana Supreme Court.

Harrison helped to form the 70th Indiana Regiment (volunteers), and in 1862 was promoted from second lieutenant to colonel. As a soldier, he was no less courageous than his grandfather. Under Hooker, he commanded a brigade at Peach Tree Creek (July 20, 1864), and in that action and at the battle of Nashville (Dec. 15, 1864) served with distinction. In 1865, he was made a brevet brigadier-general and awarded a citation for gallantry. Mustered out, Harrison returned to Indianapolis and again took up his duties with the Supreme Court, but he refused another nomination to the reportership in 1867. He turned to private practice and soon obtained a profitable clientele. He was a candidate for the Indiana governorship on the Republican ticket in 1876, but was not elected. Three years later he received an appointment to the Mississippi River Commission. His growing political stature was evidenced in 1880 by his chairmanship of the Indiana delegation to the Republican convention which nominated Garfield. After the latter's election, Harrison assumed his seat in the United States Senate, to which he had been elected in 1880. He remained in the upper house until 1887, and by reason of his effective oratory became one of the Republican leaders. He resisted Cleveland's repeated vetoes of pension bills, constantly urged increase of the naval strength, and, in his office of chairman of the Committee on Territories, sought the admission of Montana, Washington, Idaho and the Dakotas into the Union. He was not reelected to the Senate in 1887, but in 1888 he loomed as the strongest candidate for the Republican presidential nomination. With the solid backing of the Indiana delegation, he was nominated on the eighth ballot. In the ensuing campaign against Cleveland, Harrison was never more effective as a speaker. He was elected by an electoral vote majority of 65. He took office in March, 1889, with Levi P. Morton as Vice-President.

Administration. While President, Harrison obtained the passage of much legislation for which he had vainly struggled when a senator. The Navy was strengthened, and the Dakotas, Montana, Washington and Idaho were made states. His foreign policy was characterized by firmness, treaties based on commercial reciprocity were made with many European and South American nations, and he was in part responsible for the settlement of the Samoan differences with Germany. The McKinley tariff was signed by Harrison, and he supported the Republican policy of protection, but Cleveland's attacks on the high tariff gave victory to the Democrats in 1892.

Harrison retired to private law practice at the end of his term as President. Following the death of his wife, he married her niece, Mrs. Mary Scott (Lord) Dimmick in 1896. In 1899, he was Venezuelan counsel in the boundary controversy with England. The same year he was appointed to The Hague Peace Conference. He was the author of *This Country of Ours*.

Harrison was the father of a son and daughter by his first wife, and of a daughter by his second wife. He died of pneumonia Mar. 13, 1901, at Indianapolis, Ind., and was buried in Crown Hill Cemetery, Indianapolis.

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HARRISON, JOHN (1693-1776), English watchmaker, was born in Mar. 1693 at Faulby. He was the son of a carpenter and early turned to clock and watchmaking. In 1726 he invented the self-compensating, gridiron pendulum which remained the same length at all temperatures. With this in 1728 he perfected the first chronometer and applied for the prize of £20,000, which had been standing since 1713 for any method of determining longitude within 30 mi. The suggestion of obtaining longitude by clock was unheard of and it was not until 1761 with a more perfect chronometer which had been taken to Jamaica and back, about 18 mi., with an error of 1 minute, 54½ seconds, that the British Government finally agreed that the chronometer had earned the reward. Even so Harrison was not paid until 1773. He died in London, Mar. 24, 1776.

HARRISON, WILLIAM HENRY (1773-1841), 9th President of the United States, was born at Berkeley, Charles Co., Va., Feb. 9, 1773, the 3rd son of BENJAMIN HARRISON (1740-91), a signer of the Declaration of Independence, and Elizabeth Bassett Harrison. Both of his parents were of English descent. In 1787 he entered Hampden-Sidney College, where he received training in the classics. At his father's request, he gave up liberal studies in 1790 to enter a Philadelphia medical school. When the elder Harrison died the following year, the son felt free to abandon preparations for a career which held neither interest nor promise. Accordingly, he secured an appointment as an ensign in Ft. Washington, Cincinnati, Ohio, making the journey from Virginia on foot.

Harrison's military aptitude was soon noted by his superior officers. In 1792 he received his lieutenant's

commission, and was appointed aide-de-camp by Gen. ANTHONY WAYNE. He participated in the recapture of Gen. St. Clair's lost territory, aided in the construction of Ft. Recovery, and distinguished himself under fire at the Battle of Fallen Timbers. During this period Harrison fought in all the major actions against the Indians and their British allies. He married Anna Symmes (1775-1864) in 1795, daughter of John Cleves Symmes. In 1797 Harrison's military valor was rewarded by promotion to a captaincy and he was appointed commander of Ft. Washington. Army circles were surprised when the brilliant young officer resigned his commission in 1798 and settled on a land grant at North Bend, Ohio, near Cincinnati. But his military ability was not lost to the government, for the same year President JOHN ADAMS appointed him Secretary of the Northwest Territory. In 1799 Harrison was selected by the Jeffersonian faction of the district to be the first representative in Congress from the Territory. He resigned his secretaryship and moved to Washington. While a member of the lower house, he initiated a plan by which settlers without means could obtain homesteads, and he aided in the establishment of the Territory of Indiana, including the present states of Indiana, Illinois, Michigan, Wisconsin and a part of Minnesota. In 1800 he was appointed its governor. His administration was so successful that he was reappointed by President Jefferson and President Madison. In the period between 1801 and 1812 Harrison made 13 treaties with the Indians by which the United States obtained approximately 75,000 sq. mi., and subdued TECUMSEH and his brother, The Prophet, at the battle of Tippecanoe in 1811. When hostilities were resumed the next year between the United States and England, Harrison was appointed a major-general in the Kentucky Militia, and soon afterward was commissioned a brigadier-general in the regular army. The following year he was commissioned major-general and defeated the English forces in the Battle of the Thames. In the campaigns in which he participated his generalship was, on the whole, successful.

His succession of military and civil achievements brought Harrison into political prominence. In 1814 he resigned from the army, and from 1816-19 was a member of the House, representing the Cincinnati district. In 1819-21 he served in the Ohio Senate, in 1825-28 he sat in the Senate, and for a few months in 1828 he was American minister to Colombia. Until 1835, when Harrison was first mentioned as a Whig presidential possibility, he engaged in farming on his estate at North Bend. As one of several Whig candidates in 1836 he received 73 electoral votes, and he received the party nomination in 1840, with JOHN TYLER for Vice-President. Harrison was elected after one of the most furious and picturesque campaigns in American political history. He received 234 electoral votes to Van Buren's 60. Taking office in March 1841, Harrison appointed DANIEL WEBSTER as Secretary of State, THOMAS EWING as Secretary of the Treasury, and John Bell as Secretary of War. Less than one month after the inauguration, he contracted pneumonia, and died at the White House, Apr. 4, 1841. He was buried at North Bend. Harrison was the father of six sons and four daughters. His grandson, BENJAMIN HARRISON, was the 23rd President of the United States.

BIBLIOGRAPHY.—Dorothy Byrne Goebel, *The Life of Harrison,* 1926.

HARRISON, a town of Hudson Co., N.J., located on the Passaic River facing Newark. Its transportation facilities include the Pennsylvania, the Lackawanna and the Erie railroads, the Hudson and Manhattan Rapid Transit line and trolleys. A part of the industrial district of Newark, it is devoted principally to manufacturing, its products in 1929 being valued approximately at $62,000,000. Among its various important industries are the manufacturing of pumps, incandescent lamps, roller-bearings, wire and elevators. In 1929 the retail trade amounted to $4,027,664. Named in honor of President WILLIAM HENRY HARRISON, it was created a separate township from Lodi in 1840. What is now the town of Kearny was separated from it in 1867 and Harrison was incorporated as a town in 1873. Pop. 1920, 15,721; 1930, 15,601.

HARRISONBURG, a city in northwestern Virginia, the county seat of Rockingham Co., situated 125 mi. southeast of Washington, D.C., and served by bus lines and three railroads. Harrisonburg is a market center for poultry, grains and dairy products, and has silk, furniture and shoe factories. It is the seat of a State Teachers College, and in the center of the Shenandoah Valley cavern region. Harrisonburg was founded in 1780. Pop. 1920, 5,875; 1930, 7,232.

HARRODSBURG, a city in central Kentucky, the county seat of Mercer Co., situated 74 mi. southeast of Louisville and served by the Southern Railroad. Tobacco, corn and wheat are grown in the vicinity. Near the city are Graham Springs, Kentucky Pioneer Memorial State Park, and Dix Dam, said to be the largest rock-filled dam in the world. Harrodsburg was an important stronghold against the British and Indians in the early history of America. It was founded in 1774 by James Harrod and was incorporated in 1783. Pop. 1920, 3,765; 1930, 4,029.

HARROWS, implements for destroying weeds and for preparing a seed bed by pulverizing and smoothing the soil, usually on ground that has been previously plowed. Harrows may be drawn with horses or tractors. They are of three different types: disk, spring-tooth and peg-tooth. The disk and spring-tooth harrows penetrate the soil from three to five ins., while the peg-tooth type merely smoothes the surface.

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HARROW SCHOOL, a noted boys' school at Harrow-on-Hill, Middlesex, England, 12 miles northwest of London. It was founded in 1571 by John Lyon, primarily to afford a sound education to 30

boys of the parish. The original red brick schoolhouse, now the historic Fourth Form School, was opened in 1611. The number of students is about 600; the age of entering is from 12 to 14. Two of its most notable buildings, which are mainly of the 19th century, are the Vaughan Memorial Library and the Speech Room. Among its distinguished alumni Harrow counts Byron, Sheridan, Trollope and Lord Palmerston. Its headmaster in 1931 was Cyril Norwood. *See also* ETON COLLEGE; RUGBY SCHOOL; WINCHESTER COLLEGE.

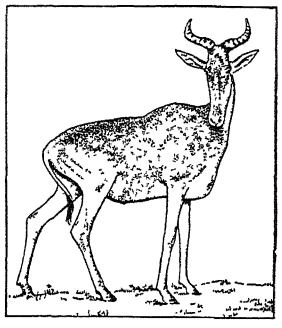
HART, ALBERT BUSHNELL (1854-), American historian and educator, was born at Clarksville, Pa., on July 1, 1854. He was educated at Harvard and at Freiburg, Germany. In 1883 he began teaching history at Harvard. From 1910-26 Hart was professor of government in the same university, becoming professor emeritus in the latter year. In 1909 he was president of the American Historical Association and in 1912 president of the American Political Science Association. From 1911-20 Hart was editor of the American Year Book, and he resumed this work in 1926. From 1923-29 he was editor of *Current History*. He has written several historical works, which include *The Formation of the Union, The Foundations of American Foreign Policy, Slavery and Abolition* and *America at War*.

HART, SIR ROBERT, First Baronet (1835-1911), Irish-Chinese statesman, was born Feb. 20, 1835, at Milltown, Ireland. He entered the British consular service in China in 1854 and became inspector for customs. In 1863 he was appointed chief of the customs and in 1869 inspector general of foreign customs and of postal service. After long and distinguished service, in July 1907 he was displaced as the head of the service by a Chinese administrator. He died in England Sept. 20, 1911.

HARTE, FRANCIS BRET (1839-1902), American author, was born in Albany, N.Y., Aug. 25, 1836, the son of a school teacher. As the boy's health was poor, he received most of his education at home, where he read widely of the best in literature. When he was 11, his first poem was published in a New York paper. His father's early death sent him out on his own at 13, and at 19 he went to California, where he taught school, clerked for an apothecary and was express manager on a stage coach. In 1857 he worked as a type-setter for *The Golden Era,* in San Francisco, but soon was contributing editorials and sketches. In 1864 Harte secured the secretaryship of the California mint and had more time for writing. His first work, *Condensed Novels,* parodies of well-known fiction, appeared in *The Californian.* In 1868 he became editor of *The Overland Monthly* and the first short story he wrote for it, *The Luck of Roaring Camp,* brought demands for his work from the East. After the publication of his famous poem, *The Heathen Chinee,* two years later, he went to New York City, where he was in great demand as a lecturer as well as a writer. The author spent all the money he made, however, and soon found it necessary to accept a government post in Germany. Later he was Consul to Glasgow. He was extremely popular in the British Isles, where the best of his stories, *The Outcasts of Poker Flat, Tennessee's Partner, The Twins of Table Mountain, The Ancestors of Peter Atherley* and *Left Out on Lone Mountain,* had made him known. Bret Harte was one of the first American writers to depict the gold-rush days of the West, and he ranks high for his qualities of picturesqueness, vividness and humor. He died in Camberley, England, May 5, 1902. *See also* AMERICAN LITERATURE.

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HARTEBEEST (*Bubalis cama*), a large South African antelope, once ranging in great herds from Cape Colony to Rhodesia, now found only in remote parts. Long, lyre-shaped, ringed horns turning back at the tip in a sharp angle are present in both sexes. It stands 4 ft. high at the withers, which are heavier and taller than the drooping hindquarters. The long head tapers to a narrow muzzle, the tail is like a cow's. The general color is reddish or grayish brown with pale patches on the haunches and black markings on the face. The hartebeest is one of the swiftest of African antelopes. Allied to it are about 10 other antelopes scattered through the length of eastern Africa south of Egypt.



HARTEBEEST

HARTFORD, the capital city of Connecticut, and the county seat of Hartford Co., situated as a port on the Connecticut River, about 36 mi. from Long Island Sound and 112 mi. northeast of New York City. Bus and truck lines, airplanes, steamships and the New Haven Railroad afford transportation. The white granite capitol stands on a hill in Bushnell Park. It contains the chair carved from the Charter Oak in which the royal charter of the colony was hidden for two years. Hartford is an insurance and industrial center. Its chief manufactures are electrical goods, foundry products and machine tools. The factory output, 1929, was worth $157,241,974. The wholesale trade, 1929, amounted to $73,056,165; the retail business to $134,702,275. Hartford was founded by Thomas Hooker in 1636; in 1784 the city was chartered, and in 1896 it became co-extensive with the town. For many years Hartford and New Haven divided the privileges and honor of being the State capital. Pop. 1920, 138,036; 1930, 164,072.

HARTFORD CITY, a city in eastern Indiana, the county seat of Blackford Co., 52 mi. southwest of Fort Wayne. It is served by bus and trolley lines and two railroads. Glass, doors and paper are the principal manufactures. Grain is raised extensively in the vicinity. Hartford City was founded in

1839 and incorporated in 1894. Pop. 1920, 6,183; 1930, 6,613.

HARTFORD CONVENTION, an assembly of 26 delegates from the New England states which met at Hartford, Conn., Dec. 15, 1814, to reach a common attitude toward the WAR OF 1812. George Cabot was chosen president, Theodore Dwight secretary. The convention deliberated in closed session for three weeks, with inviolable secrecy enjoined upon the members. The popular belief was that the convention would recommend the secession of the New England states from the Union. President Madison sent an agent to report whatever he could discover of the deliberations. To vindicate the convention against the rumored charges of its intentions, an official report of its proceedings was issued. From this it appeared that several constitutional amendments were proposed: restricting the power of Congress to declare war, to admit new states, to lay embargoes and restrict commerce; limiting a president to a single term; prohibiting the election of two presidents in succession from the same state; excluding foreign-born citizens from Federal offices, and omitting slaves from the enumerations upon which direct taxes and representation are based. The New England states were urged to protect their citizens against conscription for military service by act of Congress, and to negotiate with the National Government for the right to use revenues collected within their borders for their own defense. Massachusetts and Connecticut formally approved these resolutions. Popular exaggeration of the treasonable character of the Hartford Convention was a leading cause of the dissolution of the FEDERALIST PARTY.

HARTFORD FERN, the name given in the eastern United States to the beautiful native CLIMBING FERN (*Lygodium palmatum*), which is sparingly cultivated.

HARTMANN, KARL ROBERT EDUARD VON (1842-1906), German philosopher, was born at Berlin, Feb. 23, 1842. He was Schopenhauer's (*see* SCHOPENHAUER, ARTHUR) most distinguished disciple, although he represents to some extent a combination of GEORG HEGEL and Schopenhauer. Von Hartmann's most famous work, *Philosophy of the Unconscious,* appeared in 1869. In it the absolute is described as unconscious intelligence. Nature is regarded as an evolutionary process the goal of which is a meaningless nothingness. When such a state is reached the absolute has redeemed himself. Hartmann thought of his system as one of evolutionary optimism, and compared with Schopenhauer's, it no doubt is that. But the ordinary mortal would probably regard it as the essence of pessimism. Von Hartmann died at Gusslichterfelde, June 5, 1906.

HARTMANN VON AUE (c. 1170-c. 1210), Middle High German epic poet, was born a serf of the noble house of Aue in Swabia, about 1170. He received a good education which included instruction in Latin and French, and enlisted as a pilgrim in the Crusade of 1196-97. His works include *Gregorius,* an epic based on the legend of St. Gregory, *Der Arme Heinrich,* the most popular of his writings, and *Erec* and *Iwein,* two romances which introduced the ARTHURIAN LEGENDS into Germany. Hartmann Von Aue died between 1210-20.

HARTS-TONGUE FERN (*Phyllitis Scolopendrium*), a handsome plant of the true-fern family widely cultivated in numerous varieties for its highly ornamental foliage. It is a common wild fern in many parts of Europe and Asia but is very rare and known from only a few localities in North America. The firm bright-green leaves (fronds), sometimes 18 in. long and 2½ in. wide, which are heart-shaped or eared at the base, rise on slender stalks from a short chaffy rootstock. Many varieties with crested, crisped or divided leaves have been developed.

HARTSVILLE, a town in Darlington Co. in north eastern South Carolina, situated 24 mi. northwest of Florence. Bus lines and two railroads serve the town. Cotton and grain are the chief crops of the vicinity. The diversified industries include bleaching and cloth printing plants, shingle and saw mills, seed companies, paper, furniture and mattress factories, a hatchery and cannery. Hartsville is the seat of Coker College for Women. The town was incorporated in 1891. Pop. 1920, 3,624; 1930, 5,067.

HARTZ MOUNTAINS. *See* HARZ MOUNTAINS.

HARUN AL-RASHID (766?-809), the fifth Abbasside Caliph of Bagdad. He succeeded his brother Musa. Under the reign of Rashid, greatly through the wise policies of his vizier, Yahya ibn Khalid, the Abbasside dominions seem to have reached their most brilliant civilization. Rashid's court was certainly the most brilliant, drawing scholars and artists from all the Mohammedan lands and even from Byzantium. During his reign, however, the Caliphate lost parts of Africa and some eastern lands beyond the Oxus. Rashid became a familiar figure in western literature partly through the ARABIAN NIGHTS' ENTERTAINMENT, and partly through his contacts with CHARLEMAGNE, both of whom had two common enemies, the Ommaid Mohammedan powers in Spain and the Byzantine Empire. Rashid figures in many tales of the *Arabian Nights,* but the picture drawn of him there, particularly his nocturnal wanderings incognito, do not seem to be borne out historically. He died in Tus in 809.

HARVARD, JOHN (1607-38), English clergyman and founder of Harvard University, was born at Southwark, England, Nov. 1607. He graduated from Emmanuel College, Cambridge University, in 1631 and then studied theology. In 1637 he came to the Massachusetts Bay Colony and was admitted as a townsman in Charlestown, Mass. Here he preached as a Congregational minister until his health forced him to give up this work. He was in America only a little over a year before he died. In his will Harvard left half of his estate, about £400, and his library of 260 books, which were mainly treatises on theology he had collected while living in England, for the establishment of a college. In 1636 the General Court of

the Massachusetts Bay Colony had voted £400 for founding a college "to educate the English and Indian youth in knowledge and godliness," and in 1637 had ordered it to be established in Newtowne, later called Cambridge. Harvard's gift was added to the original fund for the college, and in 1639 it was named Harvard College in appreciation of his contribution. He died at Charlestown, Mass., Sept. 18, 1638.

HARVARD UNIVERSITY, the oldest American university, situated principally at Cambridge, Mass. It had its origin in a gift of £400 voted by the Massachusetts Bay Co. in 1636 towards the founding of a "colledge," the organization of which was begun in that year at Newtowne, Mass., later renamed Cambridge in memory of the English university town. In 1636 an English Non-Conformist clergyman, JOHN HARVARD, died at Charlestown, Mass., bequeathing to the new institution his library of 260 volumes and one-half of his estate, approximately £400, in honor of which the school was named Harvard College. A charter was obtained in 1650. The institution was first termed a university in 1780. Harvard acquired a School of Medicine in 1782-83, a Law School in 1817, and in 1819 the Faculty of Divinity was formally organized. A tremendous step forward was taken in 1824, when Harvard was divided into departments, thus ceasing to be a purely classical university of the English type. A further interesting step was made in 1916, when the tutorial system was inaugurated. The institution includes the following schools and departments: Harvard College; the Faculty of Arts and Sciences; Graduate School of Arts and Sciences; Engineering School; Theological School; Law School; Faculty of Medicine; Dental School; School of Public Health; Graduate School of Education; Faculty of Architecture, including schools of Town Planning and Landscape Architecture; the Arnold Arboretum; the Busey Institute; with which is connected the Harvard Experiment Station in Cuba; Summer School and University Extension. RADCLIFFE COLLEGE for women, 1869, is an affiliated institution. Also connected with the university are the Blue Hill Meteorological Observatory and the Astronomical Observatory. Other features are the Botanical Gardens; University Museum, founded by Louis Agassiz; the Gray Herbarium; Peabody Museum of American Archaeology; Fogg Art Museum; Semitic Museum, and the Germanic Museum. Harvard has the outstanding university library in the country, having approximately 3,000,000 books and pamphlets. In 1930 the university established the House plan to provide upper classmen with suitable living quarters and closer contacts with the members of the faculty. Harvard in 1931 enrolled 8,110 students and had a teaching staff of 1,244 members, headed by Pres. ABBOTT LAWRENCE LOWELL. Its endowment amounted to $108,087,473.

HARVESTERS, a term applied to agricultural machines for gathering crops. The corn harvester, commonly known as the corn picker, picks, husks and delivers the corn into a wagon or truck from the standing stalk. Most of the early machines were of the one-row, horse-drawn type, but the trend seems to be toward two-row, tractor-operated pickers. Such machines are either drawn by a tractor or mounted on it, and are operated by a power take-off.

Several types of machines are used for harvesting beans. A mower, binder or combined harvester-thresher is used in some localities, while in others a special harvester designed to cut and place two rows of vines in a windrow is employed.

Harvesting machinery for small grain has probably reached a higher degree of perfection than machinery for harvesting any other crop. A few years ago the grain header and self binder were considered as the last word in harvesting machinery, but these machines are being now replaced by the combined harvester-thresher. *See also* COMBINES; HEADERS; BINDERS; COTTON PICKERS; POTATO DIGGERS; BEET LIFTERS.

HARVEST MOON, the name given to the full moon nearest the 23rd of September. At that time of the year the position of the ecliptic at sunset in the northern hemisphere is such that for several days around full moon time the moon rises only a little later each evening. Consequently there is moonlight on an unusual number of consecutive evenings.

HARVEY, GEORGE BRINTON McCLELLAN (1864-1928), American editor and statesman, was born in Peacham, Vt., Feb. 16, 1864. He worked as a reporter on various newspapers and became managing editor of the New York *World* in 1891-93, and in 1899 bought and became editor of the *North American Review.* In 1900-15 he was president of Harper & Brothers, publishers. Harvey's political connections were originally Democratic, but during the Wilson administration he became a Republican. In 1921-23 he was Ambassador to Great Britain. Harvey died in Dublin, N.H., Aug. 20, 1928.

HARVEY, WILLIAM (1578-1657), discoverer of the circulation of the blood, was born in Folkestone, April 1, 1578. He was educated at Cambridge University. He studied medicine under Fabricius at Padua and received his degree of doctor of medicine in 1602. Thereupon he located in London, and was appointed to the post of physician in St. Bartholomew's hospital in 1609. In 1616 he gave his first course of lectures concerning his views upon the movements of the heart and the blood. Harvey's writings are numerous. His work had a greater influence on modern medicine than that of any other man of his time, with the exception of Vesalius. After research for more than twenty-five years, he published in 1628 his famous work *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus.* In this book he described his idea of the circulation of the blood. He was elected president of the College of Physicians in 1654, but he declined the honor. His collected works were published by his colleague Ent, in the work *Exercitationes de Generatione.* (1651.) He died on June 3, 1657. M. F.

HARVEY, a suburb of Chicago, Ill., situated 20 mi. south of that city, in Cook Co., near the Calumet

River. Railroad facilities, in combination with residential attractions, have swelled the population in recent years. The city has substantial manufactures of gas and oil well apparatus, road-building and foundry equipment and other mechanical contrivances. In 1929 the retail trade amounted to $7,846,276. Harvey was founded in 1890 and incorporated as a city in 1891. Pop. 1920, 9,216; 1930, 16,374.

HARWICH, a port and municipal borough of Essex, southeastern England. It is situated on a promontory at the point where the Stour River flows into the North Sea; London lies 70 mi. to the southwest. Shipbuilding, fisheries and the manufacturing of cement constitute the most important industries. Substantial trade relations are maintained with Germany, Denmark and Holland; fish, cement, leather, ironware and machinery being the chief exports, and lumber, tobacco, grain and textiles, the chief imports. The fine harbor is strongly garrisoned by a modern array of large guns. During the World War, Harwich played a significant rôle as naval base for destroyers operating in the North Sea. Pop. 1921, 13,046; 1931, 12,700.

HARZ MOUNTAINS, a range in northern Germany, from which an extensive plain stretches to the North Sea and the Baltic. The chain extends from southeast to northwest, and comprises an extent of almost 58 mi. in length and 20 in breadth, embracing the towns of Brankenburg, Goslar, Klausthal, Wernigerode and others. That part which includes Brocken (about 3,800 ft.), with neighboring high peaks, is called the Upper Harz, and consists entirely of granite. The southern portion is called the Lower Harz, and abounds in woods and fine pastures. The district is rich in silver, iron, lead, copper, zinc, manganese, marble, alabaster and arsenic. The breeding of canaries forms an important industry in the towns and villages.

HASBROUCK HEIGHTS, a borough of Bergen Co., N.J., located on sharply sloping ground on the west side of the flats of the Hackensack River, 7 mi. west of New York City. It is mainly a residential suburb of New York City and Newark, N.J. Here is located Teterboro Airport, one of the airports serving New York City and also a large airplane manufacturing establishment. Hasbrouck Heights has been the home of Floyd Bennett, the first man to pilot an airplane over the North Pole, and of Bernt Balchen, the first man to pilot an airplane over the South Pole. Pop. 1920, 2,895; 1930, 5,658.

HASDAI IBN SHAPRUT (c. 915-975), Jewish physician, patron of learning and statesman in Cordova, Spain, was born about 915 at Jaen, Spain. From 940 to his death in 975 he acted as the trusted ambassador and administrator of the Mohammedan Caliph Abdul-Rahman (912-61), after having been his personal physician for many years, and of Caliph Al-Hakim II, and served at their court in Cordova. Due to Ibn Shaprut's knowledge of Latin the caliph frequently sent him as envoy to Christian countries, and he succeeded in establishing advantageous political relations between Byzantium and the Spanish caliphate, as well as with the neighboring Christian states. Through his efforts the influence of the Western European caliphs was greatly strengthened.

Through his correspondence with Joseph, King of the Khazars, Ibn Shaprut was instrumental in bringing to Western Europe the first knowledge about the KHAZARS, a people dwelling near the Caspian Sea, which accepted Judaism about the middle of the 8th century under their King Bulan. *See* JUDAH HALEVI.

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HASDRUBAL, the name of two prominent Carthaginian generals. I. The son-in-law of HAMILCAR BARCA, succeeded upon his death, 228 B.C., to the command of the Carthaginian army in Spain. Carrying on the conquest of that country, he founded New Carthage, and drew up a treaty with Rome, fixing the Ebro River as the boundary between Roman and Carthaginian spheres of influence. He was murdered in 221 B.C. II. The younger brother of HANNIBAL. Left in command in Spain when Hannibal proceeded to Italy, he fought with varying success. Defeated in 216 B.C., he routed two Roman armies in 212 B.C. Eluding Scipio (*see* SCIPIO AFRICANUS, P.C.), he crossed the Pyrenees and made his way into Italy to help Hannibal. But at the Metaurus River, opposed by two Roman armies, he was defeated and fell fighting heroically, 207 B.C.

HASIDIM ("the pious"), the adherents of a religious movement which arose among the Jews of Poland during the 18th century and who declared that sentiment, the emotion of faith, and the emotion of religious belief were more important than ritual and religious dogmas. The Hasidic movement soon spread through the Ukraine, Galicia and Lithuania, and came to embrace almost a half of the total Jewish population of Europe.

The founder of the Hasidic movement was Israel ben Eliezer Baal Shemtob, usually called Besht, an abbreviation formed from the first letter of the three Hebrew words Baal Shem Tob, meaning master of the good name. According to the doctrines of Hasidism, which was based on a form of mysticism taken from the Cabala, God is ever present to man, with whom He has everlasting communion. Constant relations prevail between the human and the divine, and every act or word of man effects corresponding echoes or vibrations in the upper, superterrestrial spheres. Communion, the chief practice of the Hasidim, can be effected through the concentration of one's entire thought on God, and through seeking His advice and feeling His nearness in all the affairs of life. Prayer, of an ecstatic and fervent kind, it was believed, is an exceptionally efficacious form of communion with God; such ecstasy, or exalted religious mood, could be produced through shouting, singing, through a religious form of dancing, or through violent movements of the body. Thus Hasidism was characterized by a new and joyful appreciation for the

whole of external nature, all of which were understood as joyous manifestations of God's proximity.

Another important principle of the Hasidim was that God was to be served only in a cheerful and happy mood, not in sorrow or sadness. It was a joyous union with God, in which all asceticism was rejected and an inner rhapsodical enthusiasm was brought about. Through constant communion with God the true Hasid could attain to the performance of miracles. Such a one was called a Zaddik (plural, Zaddikim), a righteous man, and had attained the highest form of communion possible; the Zaddik became the intermediary between God and the ordinary Hasidim and through him alone could earthly blessings be received and the salvation and deliverance of the soul attained. This reverence for the Zaddik came to be known as Zaddikism, which developed as an especial tendency within the Hasidic movement.

Although bitterly opposed by the Mithnagdim, the followers of rabbinical Judaism, Hasidism spread rapidly in the 19th century, and is still firmly established as a mass movement among the Jews of Poland and Lithuania. In Lithuania, however, where the Hasidic movement did not succeed in penetrating until about the year 1760, it assumed a more literary and rational form. Prominent among the Hasidim were Israel Besht, the founder; Baer of Meseritz, his favorite disciple; Menahem Mendel of Vitebsk; Israel of Polozk; Aaron Karliner; Elimelech of Lezajsk; Nahum of Czernobyl; Baruch of Tulzyn; Levi Isaac of Berdichev; and Jehiel Michael of Zloczow.

A. Sh.

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HASKOVO, the capital of the district of Haskovo in southern Bulgaria; situated on the international railway connecting Paris with Constantinople. It is the center of the tobacco trade. During the earthquake in 1928 which shook nearly all of southern Bulgaria Haskovo suffered severely. The mineral baths, celebrated for their curative value, dried up after the earthquake. Pop. 1931, 29,971.

HASSAM, CHILDE (1859-), American artist, was born at Boston, Oct. 17, 1859. He studied art in Boston and in Paris, where he became imbued with the principles of Impressionism, which he later carried over to American art.

Hassam has received many prizes and medals and is represented in the Metropolitan Museum, New York, the National Gallery, Washington, Chicago Art Institute, Worcester Museum, Carnegie Institute, Pittsburgh, Pennsylvania Academy of Fine Arts, Philadelphia, and elsewhere in the United States. Among his most important works are *The Little June Idyll, Evening Bells, Winter, Manhattan's Sunset Towers, The Butterfly, Aphrodite, Lorelei* and *The Summer Sea.* Hassam is also noted as an etcher.

HASSIDEANS. *See* Assideans.

HASTINGS, THOMAS (1860-1929), American architect, was born in New York City, Mar. 11, 1860. He studied at the École des Beaux-Arts in Paris, and immediately upon his graduation, in 1884, formed the firm of Carrère & Hastings. Among the most important buildings designed by the partnership were the New York Public Library; the Senate Office Building, Washington, D.C.; and the Century Theater, New York. Hastings was a member of the Legion of Honor. He died at Mineola, N.Y., Oct. 22, 1929.

HASTINGS, WARREN (1732-1818), organizer of British sovereignty in India, was born at Churchill, Oxfordshire, Dec. 6, 1732. He was educated at Westminster School, and in 1750 went to India in the service of the East India Company where, in 1756, he narrowly escaped the Black Hole of Calcutta. After the restoration of British prestige by the victories of Clive, Hastings rose rapidly. He was made Governor of Bengal in 1772 and first Governor General of India in 1774. Dignified, courageous and brilliant, he preserved, consolidated and extended British rule, but he was not above taking opportunities to enrich himself. An official, Nuncomar, who charged Hastings with corruption, was arrested on an old charge of forgery and executed. In the meantime criticism of the Company and of Hastings arose at home, and in 1777, an attempt was made to remove him. On the passage of Pitt's India Bill, he finally retired and returned to England. A member of the Council at Calcutta, Philip Francis (said to have written the Junius Letters), an enemy of Hastings who had fought a duel with him, was then in the House of Commons. With Fox, Burke and Sheridan, Francis brought charges on which Hastings was impeached before the House of Lords. He was accused of selling the services of troops for the suppression of the Afghan Rohillas, of extorting money from the Zemindar of Benares for use against the Mahrattas, and of using torture in the attempt to plunder the treasures of the Princesses of Oude. The trial in Westminster Hall included 145 sittings and lasted eight years. The House of Lords acquitted Hastings while the Company was liberally reimbursed for his expenses.

He retired to Daylesford in Worcestershire, the ancestral estate which he had purchased with his Indian emoluments. In 1813 he had to attend the House of Commons as a witness, and the members received him with acclaim. Hastings was twice married, his second wife being the divorced Baroness Imhoff. Macaulay's essay, despite its severities, is still the most picturesque account of Hastings over whose career there will always be controversy. He died at Daylesford, Aug. 22, 1818.

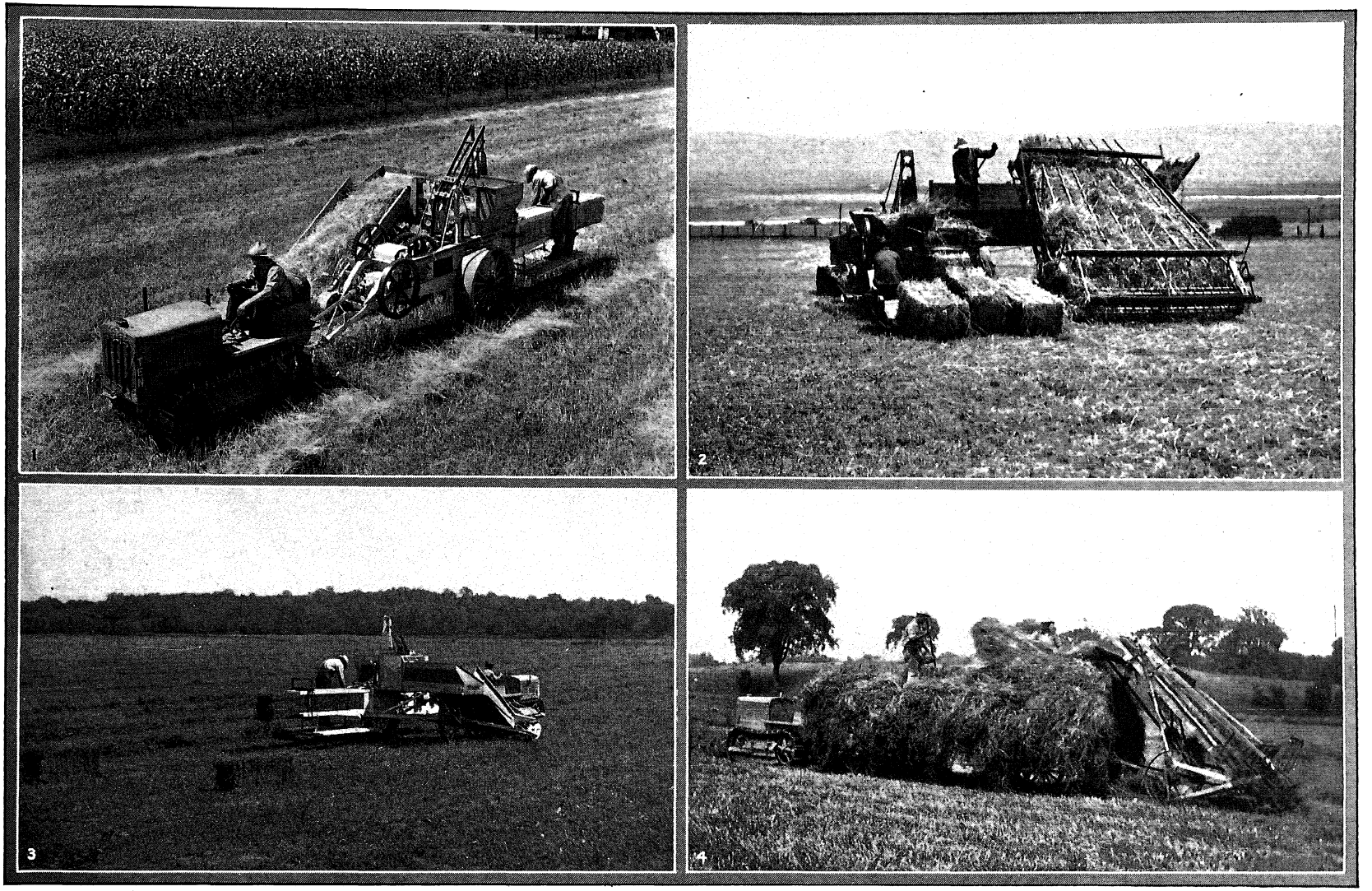
HASTINGS, county borough and watering place of Sussex, England, lying, hill-sheltered to north and east, at the mouth of two narrow valleys, upon the English Channel, 62 mi. southeast of London. A possible Iron Age or Roman-British settlement, it attained some importance in Saxon times. Upon West Cliff are ruins of a castle founded by William the Conqueror after the Battle of Hastings which was fought 6 mi. inland, near Battle Abbey. The town



1, 2, 3, COURTESY ADVANCE-RUMELY THRESHER CO., LA PORTE, IND.; 4, CATERPILLAR TRACTOR CO., PEORIA, ILL.

HARVESTING BY MACHINERY—MODERN METHODS OF HARVESTING

1. Corn husker and shredder in action. **2.** Side view of the same machine.
3. Hulling clover seed with thresher with special clover attachment. **4.** Baling soy beans at the rate of 3 tons per hour.



COURTESY CATERPILLAR TRACTOR CO., PEORIA, ILL.

HARVESTING HAY BY MACHINERY

1. Combine baler mechanism picking up hay from the windrow. **2.** Tractor pulling windrow hayloader and haypress. **3.** Rear view of a combine baler. **4.** Tractor pulling a hayrack and loader.

subsequently became chief of the Cinque Ports, but, the sea playing havoc with its two natural harbors, the inhabitants took to ship-building, privateering and smuggling that found headquarters in the caves to northeast. Now a unit with St. Leonard's on the south, Hastings boasts a fine pier, covered marine parade and the 75-acre Alexandra Park, which, with excellent beach and bathing facilities, and mild climate, make it a popular resort. For revenue Hastings depends upon its holiday visitors, although there is a small fishing trade. Pop. 1921, 66,495; 1931, 65,199.

HASTINGS, a city of southwestern Michigan, the county seat of Barry Co., situated on the Thornapple River, 38 mi. southeast of Grand Rapids. Two railroads and bus and truck lines afford transportation. Furniture and machinery are the chief manufactures. Hastings was founded in 1836 and incorporated in 1871. Pop. 1920, 5,132; 1930, 5,227.

HASTINGS, a city in southeastern Minnesota, the county seat of Dakota Co., situated on the Mississippi River, 20 mi. southeast of St. Paul. Two railroads, one with a station in Washington Co., serve the city, which is a shipping point for grain. The city has various manufactures, including flour, farm equipment and collars. Pop. 1920, 4,571; 1930, 5,086.

HASTINGS, a city in southern Nebraska, the county seat of Adams Co., situated between the Platte and Blue rivers. It is served by five railroads and an airport. In the vicinity is splendid farming and stockraising country, and the city ships grain and livestock. Harness, automobile pump and broom factories, and cold storage plants are located here. In 1929 the manufactures reached a total of about $5,500,000. The retail trade in 1929 amounted to $13,464,856. Hastings College and the State Hospital for the Insane are located in Hastings. It was settled in 1872 and received a charter in 1874. Pop. 1920, 11,647; 1930, 15,490.

HASTINGS, BATTLE OF, Oct. 14, 1066, a battle between the Normans, led by William the Conqueror, and the English, led by King Harold. On the news of William's landing, Harold, who had just repelled the invasion of Tostig and Harold Hardrada in the north, hastily collected new levies and met the Normans at Senlac Hill, six miles from Hastings. The English army consisted of infantry flanking the king's bodyguard (*huscarles*) armed with axe and shield. William's army, disposed in a center and two wings, consisted of archers and arblasters, infantry and heavily armed cavalry. With locked shields, the English infantry repelled all attacks until tempted to break ranks by a feigned Norman retreat. The huscarles stood firm until virtually annihilated, Harold and his two brothers being among the slain. William became King of England.

HASTINGS COLLEGE, at Hastings, Neb., a coeducational institution, privately controlled and under the general auspices of the Presbyterian Church, was founded in 1882. The productive funds in 1931 were $810,740. The library contains 16,784 volumes. In 1931 there were 958 students and a faculty of 48, headed by Pres. Galvin H. French.

HASTINGS-UPON-HUDSON, a village in Westchester Co., southeastern New York, 19 mi. from New York City. Built on a succession of terraces on the east bank of the Hudson River, the town commands a fine view. Trolley and steamboat lines and the New York Central Railroad afford transportation. Hastings-upon-Hudson is a residential community with some manufactures, principally copper wire, paving block and chemicals. Admiral D. G. Farragut once lived in Hastings; and the John William Draper Park is a memorial to the man who made the first photograph of a human being. Hastings was incorporated in 1776. Pop. 1920, 5,526; 1930, 7,097.

HATCHET, a small ax used with one hand. Opposite the blade it usually has a hammer head for driving nails or similar work, and there is generally a notch in the side of the blade with which nails can be pulled. There are several types of hatchets, such as those for lathers.

HATTIESBURG, a city of southeastern Mississippi, the county seat of Forrest Co., situated on the Leaf River, about 85 mi. southwest of Meridian. Four railroads, bus lines and a municipal airport provide transportation. Lumber products and naval stores are the chief local manufactures. The annual factory output is valued at about $8,000,000. The retail business in 1929 amounted to $9,203,387. Cotton, corn, hay and fruits are grown in the region. Mississippi State Teachers College and Mississippi Woman's College are located here. Hattiesburg was founded and incorporated in 1884. Pop. 1920, 13,270; 1930, 18,601.

HAUCH, JOHANNES CARSTEN VON (1790-1872), Danish poet and dramatist, was born at Frederikshald, Norway, May 12, 1790. His childhood was spent in Norway, but he was educated at the University of Copenhagen where he subsequently became professor of esthetics. His principal dramatic works are *Tiberius, Gregorius VII, Tycho Brahe's Youth, The Sisters of Kinnekullen* and *Honor Lost and Won.* He wrote three volumes of poems, chiefly lyrics, and several historical novels, including *Vilhelm Zabern, The Alchemists, A Polish Family, The Castle on the Rhine* and *Robert Fulton.* He died at Rome, Mar. 4, 1872.

HAUGESUND, a city and port of Norway in the district of Rogaland, about 35 mi. northwest of Stavanger, opposite Karmo Island. It trades in fish and engages in shipping, shipbuilding and fish-canning. Nearby to the north is Haroldstötten, a millennial monument erected in 1872. Pop. 1930, 17,166.

HAUNTINGS, the supposed return of the spirits of the dead to torment those who injured them in life or were responsible for their death. Primitive belief includes the tradition that the dead may thus punish the living. Haunted houses play a large part in the belief in GHOSTS. The revelations of modern SPIRITUALISM began with a case of rappings by a peddler supposed to have been murdered in the house.

Haunted houses were made the subject of an inquiry by the Society for Psychical Research but with

no very definite result except that the tradition persists, and in a few cases is well enough authenticated by reliable witnesses to suggest various theories, none of them inconsistent with a natural explanation under expectant attention. The prevalence of dread in lonely places with a weird reputation is sufficient to keep the belief alive. *See also* POLTERGEIST.

HAUPT, PAUL (1858-), German American Assyriologist, was born at Gorlitz, Germany, Nov. 25, 1858. After his studies at Leipzig and Berlin, and a period as professor of Assyriology at the University of Göttingen, he became professor of Semitic languages and director of the Oriental Seminary, at Johns Hopkins University, Baltimore, Md. He is chiefly known by his works on biblical research and criticism, including the *New Critical Edition of the Hebrew Text of the Old Testament* (1892), *The Aryan Ancestry of Jesus* (1909), and his editorship of *The Polychrome Bible* (1898).

HAUPTMANN, GERHART (1862-), German poet and dramatist, was born at Salzbrunn, Silesia, Nov. 15, 1862. His father was in humble circumstances and his early education was irregular. After completing his academic training in Jena, he traveled in South Europe and finally settled in Berlin. He now devoted all his time to the pursuit of literature, taking as his avowed models the great masters, Zola, Tolstoy and Dostoyevsky. His first drama, *Before Sunrise,* was written in 1889, and he soon obtained a major rank and an international reputation among European dramatists. Hauptmann's plays exhibit the interplay of weak individual will against the blighting influence of racial inheritance, class inequality and social inhibitions. The individual will is therefore blocked and thwarted, violently swerved from its ideal gropings and reduced to tragic writhing in the throttling grasp of fate. *The Weavers,* 1892, for example, impressively demonstrates the impossibility of rising above a background of class degradation and oppression. *Michael Kramer,* 1900, is an arresting study of socially imposed shiftings of the will and the tragic opposition to a wholesome integration of character. *The Sunken Bell,* 1896, once more visualizes the starkness of the disharmony between the ideal and the actual. Of the 24 plays that Hauptmann produced from 1889 up to the outbreak of the World War, not all were of this realistic social-drama type. A goodly proportion are of the historical-legendary and the poetical-ideal type, showing imaginative and interpretative powers of a high order. Good examples are *Schluck und Jau,* 1899, *Henry of Aue,* 1902, *Charlemagne's Hostage,* 1908, and *The Bow of Odysseus,* 1914. Winner of the Nobel Prize for literature in 1912, Hauptmann holds a unique position in contemporary European literature. In 1932 he visited America.

BIBLIOGRAPHY.—*Dramatic Works,* ed. in English trans. by Ludwig Lewissohn, 1912-17; C. von Klenze, *From Goethe to Hauptmann,* 1926.

HAUSA, a language of the Nigero-Chadian subgroup of Sudano-Guinean, written in Arabic characters, and spoken by over 12,000,000 people in Nigeria and the adjacent countries. Its chief features are clear articulation, use of tones to distinguish words, numerous dissyllabic words, distinction between masculine and feminine in the singular, and simple verbal forms. Much of its vocabulary is borrowed from ARABIC.

BIBLIOGRAPHY.—J. Lippert, *Haussa-Grammatik,* 1906; A. Mischlich, *Lehrbuch der Hausa-Sprache,* 1911; Landeroin and Tilho, *Dictionnaire et grammaire haoussa,* 1909.

HAUSSMANN, GEORGES EUGÈNE, Baron (1809-91), French publicist, was born in Paris, Mar. 27, 1809. After studying law, he entered politics and in 1853 was chosen Prefect of the Seine, to carry out the plan of Napoleon III for the rebuilding of Paris. To permit the use of artillery in quelling insurrections Haussmann cut boulevards through populous sections, and then laid out the Bois de Boulogne, built new bridges, installed new water and drainage systems, erected the Opera House and other public buildings, spending such vast sums that he was severely censured and at last dismissed. After the fall of the Second Empire he became a member of the Chamber of Deputies. The Boulevard Haussmann was named in his honor. He died in Paris, Jan. 11, 1891.

HAVANA, the capital of Cuba and the chief commercial city and an important tourist point of the West Indies, situated on the northern coast of the island, south of Key West, Fla.

American influence has led to the reorganization of Cuba on modern lines, and American business spirit and methods now prevail. Narrow streets and paths, hardly permitting two vehicles or two persons to pass each other, have given place to wider thoroughfares and broader sidewalks; public gardens have been laid out and more modern business premises erected. A fine new boulevard, a fashionable society drive, now runs along the seashore. There are imposing government and municipal buildings, large hospitals and hotels, squares adorned with statues and noble trees, large theaters such as *The Tacon,* seating 3,000, the magnificent India Park and many palatial residences. The president's palace and the senate, standing in the Plaza de Armas, are quite worthy of this beautiful city. The fashionable residential neighborhood, the Prado, is a specially fine thoroughfare. A feature of the homes, as well as of many of the public buildings and stores, is the liberal use of white marble in their construction. The Roman Catholic cathedral and a number of monasteries are notable buildings. Protestant churches established in recent years are making rapid progress. In 1930 the University of Havana, founded in 1721, had 6,332 students, of whom 1,300 were women.

Havana is on a nearly level site, and has a wide and attractive approach along the sea. Some of the finest buildings and streets are along the waterfront, and the surf beats high against the sea wall which protects the driveway known popularly as the Malecón. At the eastern edge of the entrance to the bay

is a promontory surmounted by the imposing Morro Castle, a famous Spanish fortress of colonial days, now used as a Cuban military school.

The staple industry is the manufacture of the celebrated Havana cigars. The most important articles of export are tobacco leaf, manufactured tobacco, cigars and cigarettes; other exports are sugar, molasses, honey and rum. The city was founded about 1512. It was taken by the British in 1762, but was restored to Spain the following year. It was in Havana harbor on Feb. 15, 1898, that the U.S. battleship *Maine* was blown up, precipitating the SPANISH-AMERICAN WAR. Est. pop. 1930, 589,079.

HAVASUPAI, a small, isolated North American Indian tribe, speaking a dialect of the Yuman linguistic stock and occupying Cataract Canyon of the Colorado River in north-central Arizona. In spring and summer they occupy a village near the mouth of the canyon; the rest of the year they live on the plateau above in semi-permanent houses. They are agriculturists and practice irrigation, but are still largely untouched by white influence. Their social organization is simple; no ceremonial nor clan grouping has been observed and religion and ceremony occupy only a minor place in their lives.

HAVELL, ROBERT, JR. (1793-1878), English engraver, was born at Reading in 1793. At thirty he was chosen to engrave Audubon's *Birds of America.* These plates are still unsurpassed in their kind. He settled in the Hudson River Valley in 1839, and executed many excellent aquatint views of Hudson River scenery. In 1848 he published his engraving, *West Point from Fort Putnam,* after a painting by himself. He engraved a *View of the City of Hartford,* and engravings of other American cities. He died at Tarrytown, N.Y., in 1878.

HAVERFORD, a township of southeastern Pennsylvania, in Montgomery Co., situated on the Pennsylvania railroad about 10 mi. northwest of Philadelphia. It is the seat of Haverford College, a college for men founded in 1833, and Haverford School. Haverford is almost entirely a residential district of Philadelphia. Pop. 1920, 6,631; 1930, 21,362.

HAVERFORD COLLEGE, an institution for men at Haverford, Pa., chartered in 1833, is under the control of the Society of Friends. The college was an outgrowth of Haverford School, established to provide a "guarded education" for the sons of members of the Society of Friends. Its productive funds in 1931 were $3,988,099. The library of 122,860 volumes contains notable Quaker collections. In 1931-32 there were 311 students enrolled, and a faculty of 42, headed by Pres. William W. Comfort.

HAVERHILL, a city of Essex County, northeastern Massachusetts, on the Merrimack River 33 miles north of Boston. It is served by the Boston & Maine Railroad. Haverhill is one of the principal shoe-manufacturing centers of the United States; other products include woolen goods, leather, hats and boxboard. In 1929, the value of manufactures was $45,750,082; of retail trade, $20,422,852. Founded in 1640, Haverhill first received its charter in 1645. John Greenleaf Whittier was born here. Pop. 1920, 53,884; 1930, 48,710.

HAVERHILL MASSACRE, Aug. 29, 1708, a frontier tragedy of QUEEN ANNE'S WAR. A raiding party of Indians and French commanded by Hertel de Rouville, who had instigated the DEERFIELD MASSACRE, rushed into the village of Haverhill, 33 miles north of Boston, and under cover of darkness captured it without difficulty. Sixteen inhabitants were wantonly murdered, and 35 carried back to New France. This massacre is notorious because of the extreme vengefulness and brutality of the murders.

HAVERSTRAW, a village in southeastern New York, in Rockland Co., situated on the right bank of the Hudson River, 35 mi. north of New York City. It is served by river craft and the New York Central and Erie railroads. The chief local industries are silk-dyeing, brick-making and the manufacture of clothes for women and children. It is situated in a district producing truck crops. Haverstraw is also a popular resort. Pop. 1920, 5,226; 1930, 5,621.

HAVRE. *See* LE HAVRE.

HAVRE, a city in northern Montana, the county seat of Hill Co., situated on Milk River, 123 mi. northeast of Great Falls. It is served by the Great Northern Railroad. There is an airport. Havre is the seat of the Northern Unit of Montana University. It lies in a rich grain-growing section, and has flour mills and packing houses. Havre was founded in 1889; incorporated in 1903. Pop. 1920, 5,429; 1930, 6,372.

HAW, BLACK (*Viburnum prunifolium*), a shrub or small tree of the honeysuckle family, called also stag-bush. It is native to rocky soils from Connecticut to South Carolina, ranging westward to Michigan and Kansas, and often cultivated for ornament. It sometimes grows 20 to 30 ft. high with a short crooked trunk and stiff spreading branches. The tree bears oval, finely toothed leaves, showy clusters of pure white flowers and a bluish-black, edible fruit, about ½ in. long, containing a single flattened stone. The bark is used medicinally.

HAWAII, a territory of the United States, composed of 20 islands in the mid-Pacific, about 2,100 mi. southwest of San Francisco and 3,400 mi. east of Yokohama. Total area about 6,449 sq. mi.

The inhabitants in 1930 numbered 368,336, an increase of 43.9% over 1920 and 139.1% over 1900 when the islands were annexed by the United States. The pop. in 1900 was 154,001; in 1910, 191,909; and in 1920, 255,910.

The nine inhabited islands with area and 1930 census are Hawaii, 4,015 sq. mi., 73,325; Maui, 728 sq. mi., 48,756; Oahu, 559 sq. mi., 202,887; Kauai, 547 sq. mi., 35,806; Molokai, 261 sq. mi., 5,032; Lanai, 139 sq. mi., 2,356; Niihau, 97 sq. mi., 136; Kahoolawe, 69 sq. mi., 2; Midway, 2.7 sq. mi., 36. In 1930 there were two cities with over 10,000 people, —Honolulu, the capital, on Oahu with 137,582; Hilo on Hawaii with 19,468.

The people represent a complexity of nationalities, languages and religions. In 1929 the population by races was estimated at Japanese, 137,407; Filipinos 63,867; Americans, British, Germans and Russians 38,006; Portuguese 29,717; Chinese 25,211; Hawaiians 20,479; Caucasian-Hawaiians 16,698; Asiatic-Hawaiians 10,598; Porto Ricans 6,923; Koreans 6,993; Spanish 1,851.

Surface and Climate. The islands are largely mountainous and chiefly volcanic in origin. Hawaii Island is formed by five volcanoes which have encroached upon one another by eruptions. It has Mauna Kea, 13,805 ft. high, quiescent, the highest elevation in the Pacific; Mauna Loa, 13,675 ft., periodically very active, which probably has poured out more lava in the last century than any volcano on the globe; and Kilauea, 4,400 ft., with the largest active crater in the world, in violent eruption in 1924 and 1929. Maui consists of volcanic twins united at the base. One of them, Haleakaka, 10,000 ft. high, has the largest extinct crater in the world, it being 20 mi. around and about 3,000 ft. deep. Other islands are built around a single cone.

The surface generally is deeply eroded into ravines and gorges, bold and precipitous, varied occasionally by broad sandy beaches and often bordered by coral reefs. Along the coasts and among the mountains are plains and valleys of great fertility, the decomposed lava providing a deep red soil very favorable to agriculture.

The climate is perpetual summer with little variation in temperature. At Honolulu the maximum recorded temperature is 88°, the minimum 56°, and the mean of 74.6° is 10° colder than any other place in the same latitude due to northeast trade winds which blow about ten months of the year. Because of the mountains, most of the rain falls on the northeast sides of the islands, but it varies greatly at different elevations. At Honolulu the mean annual rainfall is about 26 in. but 4 mi. distant at a height of 1,000 ft. on mountain slopes it is 155 inches. In the southwestern areas irrigation is used for cultivation.

The rivers are mostly mountain streams, many of which form picturesque waterfalls before they reach the plains.

Flora and Fauna. The islands have an extensive tropical flora including about 900 species of flowering plants, one-third of which are trees and about 150 ferns, together with numerous mosses and lichens. About five-sixths of the flowering plants are peculiar to the islands. Characteristic of indigenous trees is the koa, a species of acacia, which grows to a great size and furnishes valuable lumber called Hawaiian mahogany. It was formerly used for making canoes. A native screw pine has a fibrous wood suitable for making mats, ropes and fishing nets.

Various species were brought to the islands in early days by the Polynesians who carried their food plants with them. Among these were the coconut, the breadfruit and taro, the roots of which are used to make poi, the chief food of the native Hawaiians. Since the discovery of the islands by Europeans hundreds of plants have been introduced including the avocado, mango, pineapple, papaya, guava, coffee and citrus fruits.

The plant growth is characterized by luxuriant foliage and large showy flowers with red, orange and yellow as predominant colors. Of the indigenous flowering shrubs, the hibiscus grows in great profusion and is the official flower. Other ornamentals commonly grown include oleanders, poinsettias, bougainvilleas and the night-blooming cereus with waxy white blossoms nearly a foot in diameter.

The indigenous land fauna, which is very limited, includes a small bat, several lizards and about 100 species of birds. The coastal waters, however, are rich in marine life, especially fishes of which there are more than 600 species, including many of peculiar form and brilliant coloration. Various domestic animals have been introduced and now exist in large numbers. In 1930 the livestock included 140,600 beef cattle, 12,000 dairy cattle, 18,200 horses, mules and asses, 22,000 sheep, 43,000 hogs and 221,000 chickens.

Agriculture and Manufactures. Agriculture is the chief industry. In 1920 the farms and plantations numbered 5,284 comprising 2,702,245 acres, about one-half the total land area. In 1929-30, 239,796 acres were planted to sugar cane and 132,835.44 acres were harvested, yielding 7,639,276.10 tons of cane from which 914,637.53 tons of raw sugar were ground. The total number of employees on sugar plantations was 56,117.

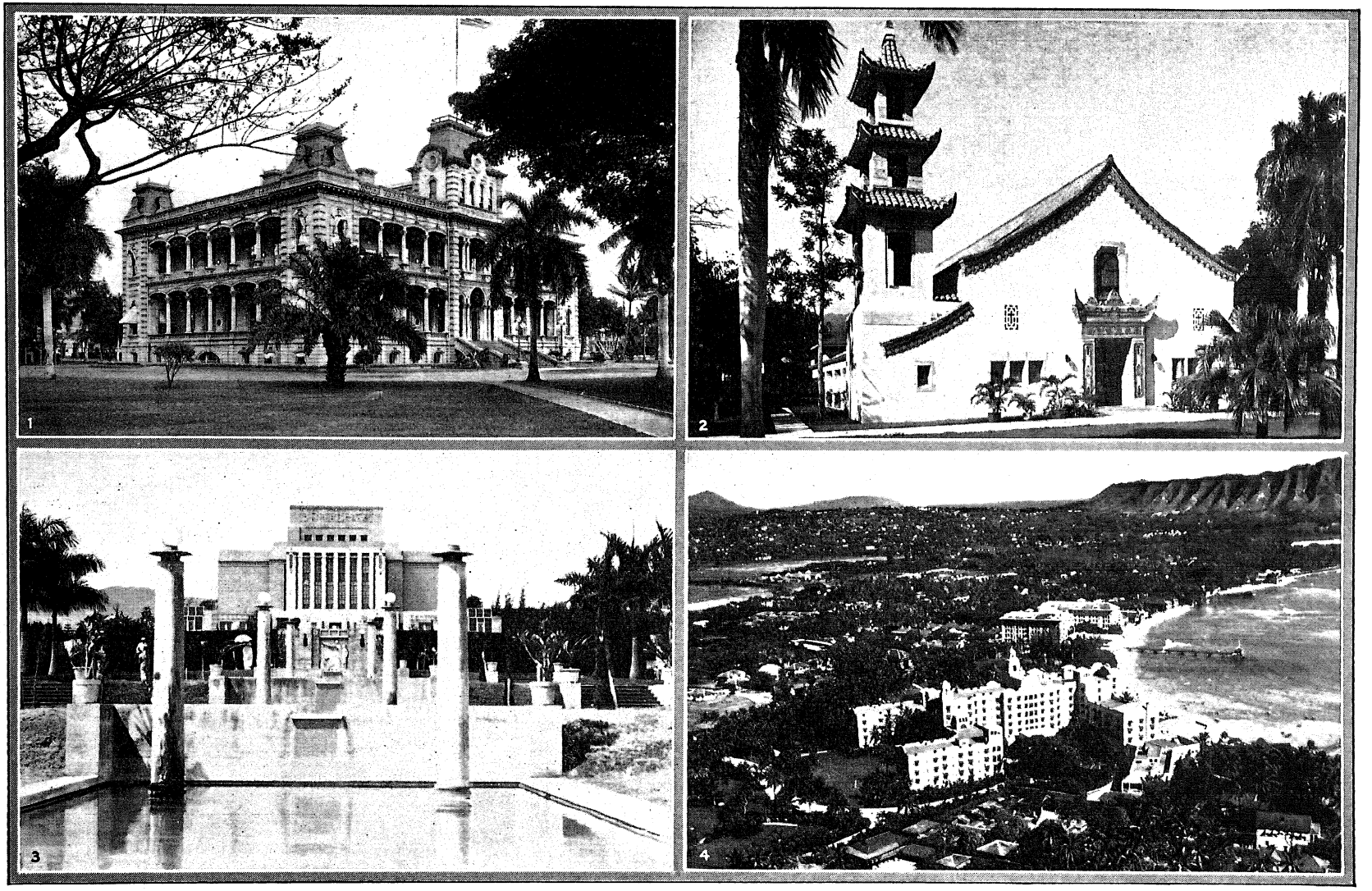
For the same period about 88,000 acres were devoted to growing pineapples, an industry second in importance to sugar. The bulk of this crop is prepared for the market in Hawaiian canneries. In 1929 the pineapple pack amounted to 9,211,376 cases of 24 cans each valued at $39,880,138. The market for this product is steadily increasing and new areas are being devoted to it. The acreage of coffee fields in 1929-30 was 5,266, the yield from which was 7,000,000 lbs. Production of coffee is increasing.

Manufactures are limited largely to canning pineapple and processing sugar cane.

Trade and Transportation. In 1929 the total foreign commerce was $200,854,037, of which $108,439,103 was exports and $92,414,934 imports. Trade is chiefly with continental United States to which exports in 1929 included 1,764,856,000 lbs. of sugar, $61,915,000; 28,370,000 gal. of molasses, $1,016,000; 439,867,000 lbs. of canned pineapple, $38,431,000; and 5,300,000 lbs. of coffee, $1,323,000.

Imports from the United States in 1929 amounted to $82,611,424 and included flour and other grain products, beverages, textile products, lumber, nonmetallic metals, oils, machinery, automobiles and chemicals.

Transportation facilities within the islands in 1928 included 374 mi. of railway lines in addition to the private lines on plantations; 1,717 mi. of public highways and 1,377 mi. of plantation highways. Auto-



1, 3, COURTESY CANADIAN PACIFIC STEAMSHIPS; 2, 4, MATSON-LASSCO LINE

SCENES THAT LURE THE TRAVELER TO THE HAWAIIAN ISLANDS

1. Executive Building at Honolulu. **2.** The first Chinese Christian church on the islands, in Honolulu, roofed in green tile. **3.** Mormon Temple at Laie, Island of Oahu. **4.** Royal Hawaiian Hotel at Waikiki Beach.

HAWAII

Area..6,406 sq. m.
Pop. est...368,336

PRINCIPAL CITIES

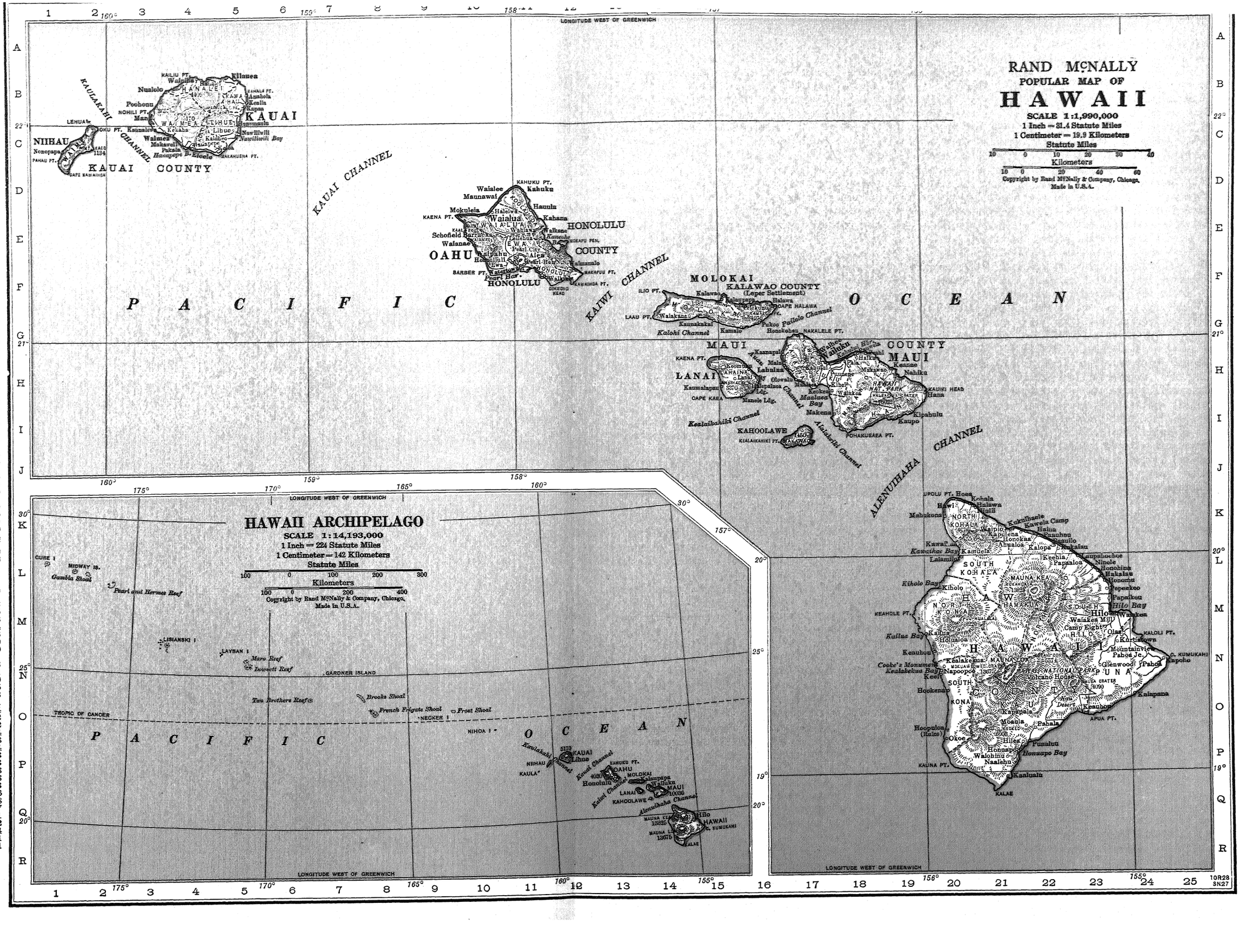
(Including Figures from Latest Population Estimates)

Pop.—Thousands

3 Aiea.....F 11
5 Ewa.....F 11
2 Haiku....H 18
1 Hanapepe..C 4
2 Hawi.....K 20
19 Hilo.....M 23
1 Honokaa..L 22
137 Honolulu.F 11
2 Honomu..L 23
2 Kahuku..D 11
2 Kakului...H 17
1 Kilauea....B 5
2 Koloa.....C-5
3 Lahaina..H 17
1 Paauilo...L 22
1 Pearl City.E 11
4 Puunene..H 18
4 Schofield Barracks..E 10
3 Wahiawa .E 11
5 Waialua ..E 10
1 Waianae..E 10
7 Wailuku..H 17
2 Waimea ...C 4
6 Waipahu..F 11

Pop.—Hundreds

1 Anahola ...B 5
3 Eleele .....C 4
5 Hakalau ..L 23
1 Halawa...K 20
3 Haleiwa...E 10
3 Hana.....H 20
3 Hanalei....B 4
1 Hanamaulu C 5
1 Hauula...E 11
1 Holualoa..N 20
1 Honouliuli F 11
2 Hookena..O 20
1 Hoopuloa .O 20
2 Kaanapali.H 16
4 Kailua....M 20
2 Kalaheo ...C 4
6 Kalapana.O 24
5 Kamuela..L 21
3 Kapaa.....B 5
3 Kapoho...N 25
2 Kaunakakai G 15
1 Kaupo ....I 19
1 Kawaihae.L 20
4 Kealakekua N 20
1 Kealia.....B 5
1 Keanae...H 19
1 Keei.....N 20
1 Kekaha....C 4
1 Keokea...H 17
7 Kohala...K 20
2 Kukaiau ..L 22
1 Kukuihaele K 21
5 Kurtistown N 24
4 Laupahoehoe L 23
4 Lihue.....C 5
5 Makawao.H 18
9 Makaweli..C 4
1 Mana.....C 3
2 Maunawai D 10
1 Mokuleia .E 10
1 Mountainview N 23
1 Naalehu ..P 21
2 Napoopoo N 20
2 Nawiliwili..C 5
4 Ninole....L 23
1 Niulii.....K 21
6 Olaa.....M 24
5 Paauhau..K 22
3 Pahala....O 22
2 Pahoa.....N 24
3 Paia.....H 18
1 Pakala....C 4
1 Papaaloa..L 23
5 Papaikou.M 23
6 Pauwela..H 18
3 Peahi.....H 18
5 Pepeekeo M 23
1 Pukoo....G 16
1 Waiakoa..H 18
1 Waihee...H 17
1 Waikane..E 11
7 WaimanaloF 12
1 Waiuiha ...B 4
1 Waiohinu .P 21
1 WatertownF 11


RAND McNALLY
POPULAR MAP OF
HAWAII
SCALE 1:1,990,000
1 Inch = 31.4 Statute Miles
1 Centimeter = 19.9 Kilometers
Statute Miles
Kilometers
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HAWAII ARCHIPELAGO
SCALE 1:14,193,000
1 Inch = 224 Statute Miles
1 Centimeter = 142 Kilometers
Statute Miles
Kilometers
Copyright by Rand McNally & Company, Chicago.
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LONGITUDE WEST OF GREENWICH
PACIFIC OCEAN
KAUAI CHANNEL
KAIWI CHANNEL
ALENUIHAHA CHANNEL
KAULAKAHI CHANNEL
KAUAI COUNTY
NIIHAU
KAUAI
OAHU
HONOLULU COUNTY
HONOLULU
MOLOKAI
KALAWAO COUNTY
(Leper Settlement)
MAUI COUNTY
MAUI
LANAI
KAHOOLAWE
HAWAII
HAWAII NAT. PARK
KAUAI CHANNEL
Kilauea
Hanalei
Waimea
Kekaha
Lihue
Koloa
Kapaa
Nawiliwili
Waialee
Haleiwa
Waialua
Kahuku
Waianae
Schofield Barracks
Pearl City
Aiea
Honolulu
Waikiki
Diamond Head
Kalaupapa
Wailuku
Kahului
Lahaina
Kaanapali
Kaunakakai
Kaluaaha
Pukoo
Honokohau
Kaupo
Hana
Kipahulu
Kahoolawe
Makena
Maalaea Bay
Kealaikahiki Channel
Pohakueaea Pt.
Upolu Pt.
Hawi
Kohala
Mahukona
Kawaihae Bay
Kiholo Bay
Kailua Bay
Kealakekua Bay
Hilo Bay
Honuapo Bay
Hilo
Waimea
Kamuela
Honokaa
Paauilo
Laupahoehoe
Pepeekeo
Papaikou
Hakalau
Honomu
Olaa
Kurtistown
Mountainview
Pahoa
Glenwood
Kapoho
Keaau
Nahiku
Keanae
Kaupo
Kipahulu
Kaupo
Kalapana
Kaalualu
Naalehu
Pahala
Ninole
Kukuihaele
Kawela Camp
Halina
Waipio
Kapulena
Honokaa
Ahualoa
Kalopa
Paauhau
Keahia
Papaaloa
Waiakea Mill
Camp Eight
H.I.V.O.
Volcano House
Kilauea Crater
Keauhou
Kaimu
Kapoho
Pohoiki
Opihikao
Kalae
Cape Kumukahi
Kaena Pt.
Barber Pt.
Ilio Pt.
Laau Pt.
Kahuku Pt.
Makapuu Pt.
Kawaihapa Pt.
Nakalele Pt.
Kaena Pt.
Cape Kaea
Cape Halawa
Keahole Pt.
Kaloli Pt.
Apua Pt.
Kalae
Kaula
Niihau
Lehua
Kaulakahi Channel
Kauai Channel
Kaiwi Channel
Alenuihaha Channel
Kealaikahiki Channel
Maalaea Bay
Kawaihae Bay
Kiholo Bay
Kailua Bay
Kealakekua Bay
Hilo Bay
Honuapo Bay
Cook's Monument
Tropic of Cancer
Midway Is.
Gambia Shoal
Pearl and Hermes Reef
Lisianski I
Laysan I
Maro Reef
Dowsett Reef
Gardner Island
Two Brothers Reef
Brooks Shoal
French Frigate Shoal
Frost Shoal
Necker I
Nihoa I
Cure I
Mauna Kea 13825
Mauna Loa 13675
Haleakala 10032
Puu Kukui 5788
Waialeale 5170
Kohala Mts.
Koolau Mts.
Waianae Mts.
Kaala 4030
Honolulu 1030
Waialeale 1569
Kilauea Crater 3950
Halemaumau Crater
Haleakala Crater
Hawaii Nat. Park
Volcano House
Mauna Kea
Mauna Loa
Kilauea
Hualalai
Kohala
Waialeale
Kaala
Honolulu
Haleakala
Puu Kukui
Koolau Mts.
Waianae Mts.
Kohala Mts.
Kilauea Crater

mobile licenses in 1930 numbered 41,829. Airports are maintained at Hilo and Maalaea on Maui.

In 1929-30, 1,321 vessels cleared through Hawaiian ports. The islands form the crossroads of the Pacific and are a port of call for transpacific steamships. They were visited in 1930 by 22,190 tourists.

Government and Finance. The territory is administered by a governor and secretary appointed for four-year terms by the President of the United States. These executives must be chosen from residents of Hawaii. The legislature consists of a Senate of 15 members elected for four years and a House of Representatives of 30 members elected for two years. A delegate to Washington is elected biennially and has floor privileges but no vote in the U. S. House of Representatives.

For the year ending June 30, 1930, government revenues totalled $12,530,357 and expenditures $11,666,956. The bonded debt was $31,705,000. Hawaii does not receive the moneys collected for customs and internal revenue. In 1930 customs receipts were $1,881,262.13 and the net internal revenue $5,471,434.62.

The assessed value of real and personal property in 1930 was $417,099,391 and the deposits in banks totalled $80,174,748.50.

Education. The public school system is under a superintendent of education and commissioner appointed by the governor. In 1929-30, there were 181 public schools with 73,180 pupils and 2,563 teachers; and 69 private schools with 11,835 pupils and 581 teachers. The University of Hawaii had 1,994 students. School plants, both public and private, are of a high order and teaching methods are progressive. English is the language of instruction.

History. The Hawaiian Islands were discovered in 1778 by Captain James Cook who called them the Sandwich Islands. At that time they had a native Malay-Polynesian population of about 200,000. Each island was governed by a separate king until 1790 when King Kamehameha brought them all under his authority. The rule of his dynasty continued until a revolution drove Queen Liliuokalani from the throne in 1893. That year an appeal was made to the United States for annexation and was rejected by President Cleveland on the ground that the United States diplomatic representative, backed by marines, had improperly aided the revolution. A republic was proclaimed July 4, 1894 with Sanford B. Dole as president. In 1898 a second appeal for annexation was made to President McKinley and accepted. The islands were formally organized into the Territory of Hawaii and its government provided for by an organic act of Apr. 30, 1900.

The original native population has been rapidly diminishing, chiefly through intermarriage with European and other races. To perpetuate the pure original stock the Federal Government in 1930 approved an appropriation of $1,000,000 to establish native farms on Molokai. The U.S. Government maintains its largest army post on the Hawaiian Islands with quarters for a division of 30,000 men at Schofield barracks and subsidiary forts. The Navy Department has a large base at Pearl Harbor with a powerful radio station.

HAWAII, UNIVERSITY OF, a coeducational institution of higher education at Honolulu, H.T., established in 1907 as the Hawaii College of Agriculture and Mechanical Arts. It was founded by the territorial legislature with the aid of the United States Government, and is patterned after American colleges. It receives support from both the territory of Hawaii and the United States Government. The agricultural department of the university cooperates with the United States Department of Agriculture in the conduct of an agricultural experiment station. Other departments include colleges and schools of Arts and Sciences, Home Economics, Commerce, Education, Civil Engineering, Sugar Technology, the Graduate School, Summer School, and extension courses. The grounds and buildings are valued at $1,827,230, and the library contains 53,197 volumes. In 1931-32 there were 2,025 students and a faculty of 78 headed by Pres. David L. Crawford.

HAWAII NATIONAL PARK, created by act of Congress Aug. 1, 1916, comprises three volcanic areas, Haleakala, Mauna Loa and Kilauea. The park now includes a total area of 245 sq. mi. Haleakala on the island of Maui is a gigantic extinct volcano with a crater 8 mi. long by 3 mi. wide and 2,000 ft. deep. Mauna Loa on the island of Hawaii is the world's greatest living volcano. Approximately every 5 or 10 years it becomes violently active, the last period having been in 1926. It has grown to its present height of 13,675 ft. in a comparatively short time. Kilauea, also on the island of Hawaii, an active volcano with a seething lake of fire, is the most spectacular exhibit of the Hawaiian National Park.

The various sections of this park are reached from Honolulu by inter-island steamers. The crater of Haleakala will soon be accessible by automobile. The summit of Kilauea is reached by a one-hour auto trip from the steamer landing. From Kilauea to the crater of Mauna Loa and return is a three-day journey accomplished partly by horseback and partly on foot.

A building of volcanic rock and metal on Uwekahuna Bluff forms the center of the educational activities of the park. It contains a large lecture room, a museum room, a photographic laboratory and a room for seismographic instruments. A permanent park naturalist and a seasonal ranger naturalist give lectures and conduct field trips. Another educational feature is self-guiding trails on which places of geological interest as well as the flora of the region are carefully labeled.

HAWARDEN, a town of Flintshire, N. Wales, situated near the Dee, about 6 mi. southwest of Chester, Eng. and 165 mi. northwest of London. The castle, an 18th century mansion standing in a wooded park, was long the home of Gladstone. Of the ancient Plantagenet castle, only the ruins of the keep

survive. The Early English, restored St. Deiniol's Church has a memorial window to Gladstone, and also in his memory are St. Deiniol's hostel and library. Lying in the vicinity of claybeds, Hawarden manufactures some coarse earthenware and fireclay brick. Pop. 1931, 8,000.

HAWES, STEPHEN (c. 1474-1523?), English poet, was born, according to his own statement, about 1474, probably in Suffolk. He was educated at Oxford, traveled on the Continent, and in 1502 was groom in the household of Henry VII. His mind was a storehouse of English poetry and, to judge by his chief work, the *Passetyme of Pleasure,* printed in 1509, he was learned in medieval philosophies. This poem is an allegory of man's life on earth, and follows the education of its hero, Graunde Amour. It influenced Spenser's work and made its author famous. Hawes died about 1523.

HAWFINCH (*Coccothraustes vulgaris*), a shy bird of the sparrow family found widely in Europe and adjacent Asia and Africa. It is one of the largest of the finches, about 7 in. long, with dark plumage marked with white and olive brown. The hawfinch nests in trees and shrubs, laying 4 or 5 pale olive-green eggs, and feeds mostly upon seeds and insects. Its song is scanty and poor.

HAWICK, a municipal burgh of Roxburghshire, Scotland, located about 53 mi. southeast of Edinburgh, where the Teviot and Slitrig rivers join. Its modern prosperity dating from the early 19th century, Hawick lies near Branxholm Castle, the scene of Scott's *Lay of the Last Minstrel.* On the other side of the Teviot is Wilton, a suburb. Yarn, hosiery and dyes are made in Hawick, which also has iron foundries and cattle marts. Pop. 1921, 16,353; 1931, 17,059.

HAWK, a name applied in the United States to any bird of prey that is not an eagle, a vulture or an owl, as, for examples, various falcons, buzzards, kites and harriers. These birds are of small or medium size and stout, compact build, with powerful wings, short, strongly hooked bills, and long, sharp, curved claws adapted for seizing and tearing prey. They are remarkable for their activity, astonishing swiftness of flight and keenness of vision. Although several are very destructive to game and poultry, most North American hawks feed chiefly upon small mammals, reptiles and insects that are injurious to the farmer, and should be protected rather than destroyed. This applies especially to the rough-legged hawk (*Buteo lagopus*), the broad-winged hawk (*B. platypterus*) and other hawks known also as buzzards.

In a narrower sense the term hawk is applied to the true sparrow hawks (*Accipiter*) and to the closely related goshawks (*Astur*), birds of great spirit and daring with short wings and rather long legs and tails. Representatives of these two groups are found in wooded districts practically throughout the world. Of these the Cooper's hawk (*Accipiter cooperi*), and the sharp-skinned hawk (*A. velox*) occur abundantly and the American goshawk (*Astur atricapillus*) irregularly in the United States. They are the most rapacious of North American hawks, preying almost entirely upon birds and small mammals, and destroying great numbers of game, fowl and other poultry. *See also* BUZZARD; CARACARA; FALCON; GOSHAWK; HARRIER; KITE OSPREY.

A. B. J.

HAWKBILL, the sea-turtle from which commercial tortoise shell is obtained. This carnivorous species (*Eretmochelys imbricata*) is not eaten like the herbivorous green turtle (*Chelonia mydas*) and is much smaller, the shell of an adult measuring only 2 ft. in length. The hawkbill may be recognized by the presence of four costal shields on each side, a beak-like upper mandible, and, in the adult, overlapping plates of the carapace. Widely distributed throughout the warmer waters of the world, the hawkbill is a typical sea-turtle in this enormous range and in the habit of coming ashore to deposit its eggs on beaches. It is common on the Florida and Gulf coasts, occasionally wandering as far north as Massachusetts. On the Pacific side of the continent its range extends northward to the coast of Lower California.

HAWKESBURY, a manufacturing town of Prescott Co., Ontario, Canada, situated on the Ottawa River, about 64 mi. northeast of Ottawa. Steamship and railroad connections facilitate the shipping of agricultural produce of the region, and of the manufactures of the local pulp, lumber, paper and silk mills, and butter factories. Largely of French-Canadian population, Hawkesbury has many churches, schools and other public works. It was incorporated in 1896. An interprovincial bridge between Ontario and Quebec has been opened across the Ottawa River at this point. Pop. 1921, 5,544; 1931, 5,177.

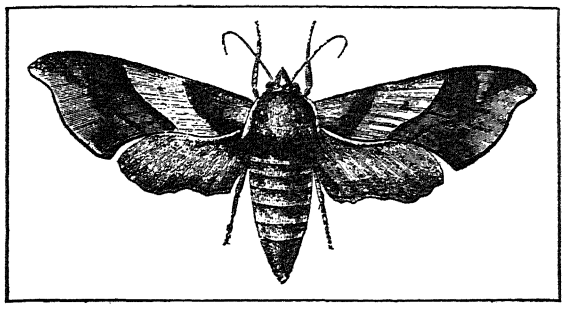
HAWKINS, SIR ANTHONY HOPE (1863-), English novelist, was born at London, Feb. 9, 1863. He was educated at Oxford, and admitted to the bar in 1887. His *Prisoner of Zenda,* published in 1894, created a vogue for romances with imaginary settings, and his *Dolly Dialogues* made popular light, satirical dialogue. *The Prisoner of Zenda* was successfully dramatized. Among other books by Hawkins are *The God in the Car,* suggested by the career of CECIL RHODES; *Rupert of Hentzau* and *Quisante.*

HAWKINS, SIR JOHN (1719-89), English musicographer, was born at London, Mar. 30, 1719. He was a friend of SAMUEL JOHNSON and one of the executors of his will. He is chiefly known for his *General History of the Science and Practice of Music* published in 1776. He was knighted in 1772. He died at London, May 21, 1789, and was buried in Westminster Abbey.

HAWKINS, SIR RICHARD (c. 1562-1622), English admiral, the son of Admiral Sir John Hawkins, was born probably at Plymouth, about 1562. When about 20 years old he went on a voyage to the West Indies and in a short time became captain of a galley in Drake's expedition to the Spanish Main. In Queen Elizabeth's service he commanded a ship against the Armada in 1588 and in 1590 accompanied his father to the Portugal coast. Ambitious to out-

shine Drake as an explorer, in 1593 he started on a world voyage in his ship *Dainty,* intending incidentally to prey upon Spanish commerce. He passed through the Magellan Straits, sailed north and plundered Valparaiso but shortly thereafter, in June 1594, was captured by the Spaniards and held a prisoner in Seville and Madrid until 1602 when he returned to England. He was knighted and made vice-admiral of Devon. He died in London, Apr. 17, 1622.

HAWK MOTH, one of the family *Sphingidæ* of lepidopterous insects, called also the "Sphinx moth." All species are large, swift flying, and usually colored in quiet hues. The long, slender tube for feeding on plant juices is coiled spirally under the head when not in use. The wings and body of the moth are covered



GREEN GRAPEVINE MOTH
(Everyx myron). One of the numerous family of hawk moths

with short, flattened hairs or scales, which strengthen the wing membrane for rapid flight. The larvæ are typical caterpillars, with chewing mouth parts, and a dorsal knob or spine at the posterior end. Some assume a stiff, erect position when disturbed, whence the name "sphinx."

HAWKWEED, the common name for a very numerous genus (*Hieracium*) of the composite family. There are more than 700 species, native chiefly to Europe and South America, some 40 of which are found in the United States and Canada. They are perennial herbs, often rough-hairy, usually with leafy stems and numerous heads of yellow flowers. Several species are sometimes grown for ornament in rockeries but they often crowd out more desirable plants and some become pestiferous weeds. Among the best known are the orange hawkweed or devil's paint-brush (*H. aurantiacum*), with handsome orange-red flowers, and the mouse-ear hawkweed (*H. Pilosella*), with pale yellow flowers, both natives of Europe which have become very troublesome weeds in the eastern states.

HAWLEY-SMOOT TARIFF ACT, 1930, a Republican measure notable for the unscientific nature of its construction and for the increases of certain rates in excess of standards for protection against foreign competition. The Republican platform of 1928 had forecast higher tariffs on agricultural products; but increases on other goods were added by the House Committee, of which Willis C. Hawley was chairman, and on the floor of the House the bill was augmented by a general distribution of favors to local interests. The bill, as reported by the Senate Committee, of which Reed Smoot was chairman, included further additions and revisions reflecting mutual concessions among the committee members. Its passage was threatened by a combination of Democrats and insurgent Republicans in the Senate, representing the dissatisfaction of agricultural interests at the rejection of a proposed export debenture plan. Joseph R. Grundy, a staunch protectionist newly appointed to the Senate, engineered an arrangement with certain insurgents whereby duties on agricultural products were advanced sharply, and in June, after having occupied Congress for a year, the measure was passed. All schedules revealed an increase, the most marked being the average rate on agricultural products, 33.62%—in the Fordney-McCumber Tariff, 19.86%—and on sundries, 27.39%—in the Fordney-McCumber tariff, 21.97%. Enacted at a time of economic depression, the measure belied the hopes of its sponsors, and was without salutary effect.

HAWORTH, a village on the edge of the moors in Yorkshire, England, famous as the home of the Brontë sisters (*see* Brontë Family). The Brontës moved in 1820 to the "low, oblong, stone parsonage" of Haworth, and it was here, greatly influenced by the somber moors, that the gifted Charlotte, Emily and Anne grew to womanhood. All of the family except Anne are buried at Haworth, and the former parsonage is now a museum containing various Brontë relics and manuscripts.

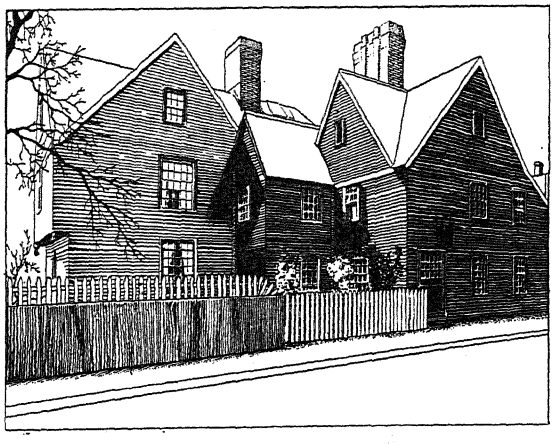
HAWTHORN, the common name for a numerous genus (*Crataegus*) of thorny shrubs and small trees of the rose family, closely allied to the apple. Several species are planted for ornament, for hedges, or for their edible fruit. The hawthorns are native to north temperate regions and include many well marked species. In size hawthorns vary from large shrubs to trees sometimes 40 ft. high. The short trunk bears numerous branches with stiff, zigzag branchlets, finely toothed, more or less lobed leaves, and white or sometimes red flowers mostly crowded in showy clusters. Two Old World species (*C. Oxyacantha* and *C. monogyna*), known as English hawthorn, may, and whitethorn, all very widely planted for hedges, especially in Great Britain, have become more or less naturalized in the eastern United States. The cockspur thorn (*C. Crusgalli*), with persistent red fruit, and the Washington thorn (*C. Phaenopyrum*), with shining scarlet fruit, both natives of the eastern states, are cultivated in several forms. In China *C. pinnatifida,* native to eastern Asia, is grown for its edible fruit.

HAWTHORNE, CHARLES WEBSTER (1872-), American figure painter, was born in Maine, Jan. 8, 1872. He studied under William M. Chase and abroad. Later he founded the Cape Cod School of Art, at Provincetown, Mass. His painting is characterized by its rich, low key. Among his works are *The Trousseau,* in the Metropolitan Museum, New York; *Mother and Child,* Syracuse Museum; *Net*

Mender, Rhode Island School of Design; *Venetian Girl,* Worcester Museum; and *The Family,* Buffalo Academy.

HAWTHORNE, JULIAN (1846-), American author, was born in Boston, Mass., June 22, 1846, the son of NATHANIEL HAWTHORNE. He studied in 1867 at Harvard, later took up civil engineering, but finally adopted literature as a career. In 1872 he published his first success, *Bressant.* His later novels include *Garth* and *A Fool of Nature,* 1897. Hawthorne also wrote several biographical studies of his father and a *History of the United States,* 1899.

HAWTHORNE, NATHANIEL (1804-64), American novelist, short story writer and essayist, was born in Salem, Mass., July 4, 1804. His ancestors, on his father's side, had been conspicuous men in 17th-century Salem, and, on both sides, he was related to some of the best families of Essex County; but the state of his immediate family was not very prosperous. On the death of his father, a ship-captain, in 1808, his mother removed, with Nathaniel and his two sisters, to the home of her own family, the Mannings; and it was to his Manning uncles that the



THE HOUSE OF THE SEVEN GABLES AT SALEM
Said to have suggested Hawthorne's novel

boy was indebted for his education. A long invalidism in his boyhood, owing to an accident to his foot; a residence of 2 or 3 years in the backwoods of Maine, at Raymond, near Sebago Lake, in his teens; and the melancholy seclusion of his widowed mother, all these cooperated to encourage in Hawthorne a natural bent toward solitude. Even during his years in college at Bowdoin, 1821-25, though he made one or two lifelong friends, such as Franklin Pierce, he failed to acquire habits of social intercourse. On returning to his uncle's house in Salem in 1825, Hawthorne began postponing his entrance into active life; and, indeed, for about 12 years he lived, like his mother and sisters, in virtual seclusion. Yet he was not merely idle. An ambition to become a writer of fiction kept him busy with his pen, and in 1828, he published, at his own expense, an anonymous novel, *Fanshawe,* which met with complete neglect. At about this time, however, owing to appeals from S. G. GOODRICH, he began contributing to Goodrich's literary annual, *The Token.* Gradually he acquired a certain shadowy reputation as a writer of stories, a reputation which brought him into the open, in 1837, with the publication of *Twice-Told Tales,* reviewed in the *North American Review* by his classmate, HENRY WADSWORTH LONGFELLOW.

By this time Hawthorne had become thoroughly dissatisfied with the "owlishness" of his life; and, after one or two unsuccessful attempts in other directions, he managed to get an appointment as measurer at the Boston Custom House in 1839. His duties, after the first novelty had worn off, proved intensely irksome to him; and in 1841 he gave up his position in order to join George Ripley and others in their communistic experiment at BROOK FARM. A year or two earlier Hawthorne had become engaged to Sophia Peabody of Salem; and at Brook Farm he at first hoped to make a home for himself and her, where he could combine writing and physical labor. But the first months in the colony proved a disillusionment; and when he at last married, in 1842, it was not to go back to the community in West Roxbury,



THE OLD MANSE
Hawthorne's home at Concord, Mass.

but to settle down in the Old Manse at Concord, where he became a neighbor of Emerson and Thoreau. Here he returned to his pen; and here he wrote most of the tales, first printed in the *Democratic Review* and other papers, which he later collected in *Mosses from an Old Manse,* published in 1846. Even here, however, the economic problem proved to be a pressing one; and, though he was not happy to return to unfriendly Salem, Hawthorne was glad enough, in 1846, to receive an appointment through his Democratic friends as Surveyor at the Salem Custom House. Uncongenial as his duties were, as before, Hawthorne was increasingly conscious of an "unquiet impulse" to write something more ambitious than he had yet done; and when, in 1849, owing to political chicanery, he was dismissed from his surveyorship, he welcomed the opportunity to set to work on the romance which, after years of relative obscurity, was suddenly to make him famous. In

1850 appeared THE SCARLET LETTER, and henceforth Hawthorne was to be one of the most eminent men of letters in America.

Encouraged by the reception of this book, Hawthorne put in 2 or 3 happily prolific years, chiefly at Lenox, Mass., of which the fruits were two romances, THE HOUSE OF THE SEVEN GABLES, 1851, and THE BLITHEDALE ROMANCE, 1852, a volume of tales entitled *The Snow Image,* 1851, and two volumes of Greek myths re-told for children, *A Wonder Book,* 1851, and *Tanglewood Tales,* 1853. In 1852, yielding reluctantly to pressure from his friend FRANKLIN PIERCE, who had been nominated for the presidency by the Democrats, Hawthorne consented to write a campaign biography of the candidate; and, after Pierce's election, he accepted an appointment from the new president in 1853 as United States Consul at Liverpool, though meanwhile he had bought "The Wayside" at Concord, and planned to settle there for good. The next 7 years of his life were spent abroad; first in England as Consul; then, in 1858-59, in Rome and Florence, where he began THE MARBLE FAUN; and again in England, where *The Marble Faun* was finished and in 1860 published.

Ill health and despondency overclouded most of the remaining 4 years of Hawthorne's life, after his return to Concord in 1860. A volume of essays based on his English notebooks, *Our Old Home,* appeared in 1863; but attempts at the writing of fiction, as in *Septimius Felton* and *The Dolliver Romance* published posthumously, proved abortive. The Civil War, and with it the discrediting of Hawthorne's Democratic connections, saddened and bewildered him; and it was as a prematurely aged man that he set out with Franklin Pierce, in the Spring of 1864, to recover his health in a trip through the White Mountains. On May 19, he died at Plymouth, N.H.

As a writer of fiction, Hawthorne is notable for his extremely delicate and personal use of New England history; for his evocation of the subtle atmosphere of places, such as Salem and Rome; for his probing psychological penetration and his interest in cases of conscience; for his introduction, along with EDGAR ALLAN POE, of the tragic note into American imaginative literature; and, finally, for the implied criticism throughout his work of the extremes of American individualism, separatism and self-reliance. Along with Poe, he is virtually one of the creators of the short story as a type; and his command over a style at once fine and firm, at once luminous and calm, makes him a genuinely classic writer. *See also* AMERICAN LITERATURE. N. AR.

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HAWTHORNE, a city in Los Angeles Co., southern California, 12 mi. southwest of Los Angeles. The city has tile, cabinet, brush and awning factories. Vegetables, hay and berries are grown extensively in the vicinity. Pop. 1920, 1,800; 1930, 6,596.

HAWTHORNE, a borough of Passaic Co., N.J., situated on the north bank of the Passaic River opposite Paterson. It is served by the Erie and Susquehanna railways and motor bus lines. The retail trade in 1929 amounted to $2,661,929. Hawthorne is principally a residential suburb of Paterson, but also has several important industries including the dyeing of silk and the manufacturing of adhesives. Pop. 1920, 5,135; 1930, 11,868.

HAWTREY, EDWARD CRAVEN (1789-1862), English educator, was born at Burnham, May 7, 1789, son of the vicar of the parish. He was educated at Eton and Kings College, Cambridge. In 1814 he became assistant master at Eton, in 1834 headmaster of Kings College, in 1852 provost of Eton, and in 1854 vicar of Mapledurham, where he died Jan. 27, 1862. Hawtrey was known as a scholar, for his fluent use of languages, as a translator into Greek and Italian and as a writer of English hexameters. On Homeric translation he was an acknowledged authority.

HAY, JOHN (1838-1905), American statesman and author, was born at Salem, Ind., Oct. 8, 1838. After his graduation from Brown University in 1858, he studied law in the office of Abraham Lincoln in Springfield, Ill., where he was admitted to the bar, 1861. Lincoln liked him and took him to Washington as his assistant private secretary when he became President. He was commissioned a major Jan. 12, 1864, and for a year acted in the nature of Lincoln's observer with troops in the field, although he never engaged in any action.

After Lincoln's death (1865), Hay was appointed the secretary of the American legation at Paris, 1865-67, and he acted in a similar capacity at Vienna, 1867-68, and at Madrid, 1869. Upon his return to the United States, he was an editorial writer for the New York *Tribune,* 1870-75. He moved to Cleveland, Ohio, in 1875 and from there to Washington, D.C., in 1885. Throughout these years, Hay associated a literary authorship of a diverse nature with an interest in national politics as a staunch Republican. From 1879-81 he was first assistant Secretary of State under William M. Evarts during Rutherford B. Hayes' administration. He was president of the international sanitary congress at Washington in 1881 and during the same year for several months acted as the editor-in-chief of the *Tribune* during an absence of Whitelaw Reid in Europe. In 1897 McKinley appointed Hay ambassador to Great Britain, where he was exceedingly popular, both socially and officially.

Hay withdrew from the ambassadorship to become Secretary of State, Sept. 30, 1898, an office which he held until his death. As Secretary of State, Hay was most energetic and aggressive in his conduct of foreign relations, yet always tempered his activities with a sense of equity towards all nations. He negotiated with Lord Pauncefote, the British ambassador, a treaty to supersede the Clayton-Bulwer Treaty of 1850 so that the United States might construct an interoceanic canal across Central America. The Senate exasperated Hay by so amending his

treaty in 1900 as to make British ratification impossible but he drew up another treaty which was ratified by both countries in 1901 and thereby enabled the United States to proceed with its canal plans without English opposition. With the decision to build the canal across Panama which was part of Colombia, the Hay-Herran Treaty was negotiated in 1903 by Hay with Herran, the Colombian minister at Washington, which provided for the construction by the United States. The Colombian legislature rejected the treaty, Oct. 30, 1903, and a few days later a revolt in Panama against Colombia was indirectly aided to success by American war vessels. Hay promptly recognized the independence of Panama and negotiated the Hay-Burnau-Varilla Treaty with the new nation whereby the United States acquired the right to build the canal. In all these transactions Hay was in close consultation with President Roosevelt, who approved them and partially guided them.

In 1899 Secretary Hay effected a settlement of the Samoan Islands dispute whereby England withdrew her claims, and Germany and United States amicably divided jurisdiction of the islands. In the fall of 1899, they persuaded the European powers and Japan to recognize the principle of the "open-door" in China, which meant the absence of discriminatory regulation of shipping and commerce within their spheres of influence. After the Boxer Rebellion, 1900, Hay tenaciously and successfully sought the adherence of the powers to their previous agreement. Among his published works are *Pike County Ballads,* 1871; *Castilian Days,* 1871; *Poems,* 1890 and the co-authorship with John G. Nicolay, *Abraham Lincoln, a History,* 10 vols., 1890. He was one of the seven original members of the American Academy of Arts and Letters, 1904. He died at Newburg, N.H., July 1, 1905.

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HAY, specifically grass cut and dried for fodder; by extension, any forage plant so treated, as, for instance, clover, oats, peas. The grasses most extensively used alone or in mixture in America are timothy, redtop, orchard-grass and brome-grass. Red and alsike clover are often grown in combination with these and other grasses as well as separately. Alfalfa under favorable conditions, being a long standing perennial legume, is generally grown by itself. Though popular in dairy sections its most extensive areas are southwestward from the central prairie states where, under irrigation, it is raised largely for baling and shipment.

In addition to factors which deal with the growing of the crop, good hay depends upon several other conditions. In general, the time to cut is influenced by the desire to get the greatest possible yield of good fodder, the weather conditions which favor most satisfactory curing, the date which will allow the development of a good aftermath or second cutting, and the digestibility of the finished product. Grass cut too early is sappy and hard to cure; that too late is woody and less digestible than that cut at just the right stage.

In parts of the country where dry weather occurs during hay making seasons no difficulty is experienced in making good hay under natural conditions. The crop is merely cut, allowed to wilt, and dry in the swath before being raked into windrows and hauled to storage quarters. In humid sections more work is generally needed, turning by hand or by tedding (tossing) machines to expose different parts of the cut grass to sun and wind. This tossing is often supplemented by extra work with rakes which collect the partially cured hay in windrows for hand cocking (piling) when the leaves are dry and the stems still too moist to store without danger of mold or spontaneous combustion. Under ordinary conditions the content of water in the grass is reduced from about 70% to 15%. Chemical changes also occur and give the finished product the characteristic fragrance of "new mown hay."

In the Gulf states and various other sections hay making by ordinary natural methods is beset by climatic drawbacks. Rain is often excessive during haymaking season with the result that the product is poor in color and digestibility. However, as the result of experiments, a process has been developed whereby freshly cut grass may be taken direct from the field to a machine which chops it finely, dries it by artificial heat and deposits it in sacks in which it is packed, tied and stored. From the time the grass enters the machine until it is sacked only a few minutes elapse, whereas field curing under even ideal conditions requires several days. Under unfavorable ones often complete failure results. Moreover, hay made by this artificial process is better colored and more digestible and nutritious than field cured hay.

HAY PRODUCTION, U.S.

7-Year Average, 1924-30

Division	*Acreage (1,000 Ac.)*	*Production (1,000 Tons)*	*% of Tot. Prod.*
UNITED STATES	73,420	93,424	100.0
LEADING STATES:			
New York	4,799	6,701	7.2
Wisconsin	3,588	6,377	6.8
Minnesota	4,211	6,190	6.6
Iowa	3,403	5,291	5.7
Missouri	3,661	4,494	4.8
Illinois	3,341	4,446	4.8
Pennsylvania	2,989	4,421	4.8
Michigan	2,976	4,247	4.5

Most crops grown for hay will not cure unless treated by one or the other of the above processes for buffalo grass, native to the prairies, dries without being cut and without noticeable loss of nutritive value. Cereal grains when cut and cured before reaching maturity make good hay but when allowed to ripen their grain they become woody, unpalatable and indigestible. Some of the clovers, especially crimson or scarlet clover (*Trifolium incarnatum*) not only become less digestible but a positive menace to the lives of horses because the plant hairs become stiff when mature and form feltlike balls in the stomachs and intestines, causing great agony and in many cases death from stoppage of the bowels. M. G. K.

HAY - BUNAU - VARILLA CONVENTION, 1903, the arrangement between the United States and the Republic of Panama for the construction and operation of the PANAMA CANAL. Secretary of State JOHN HAY and Philippe Bunau-Varilla, envoy extraordinary from the newly created Republic of Panama, agreed that the United States should pay the Republic of Panama $10,000,000, in addition to a perpetual annuity of $250,000, to begin nine years after the ratification of the treaty. In return the United States was ceded full sovereignty to a zone of territory five miles wide on either side of the canal. The treaty was ratified by the U. S. Senate Feb. 23, 1904, after a bitter debate in which resolutions censuring President Roosevelt's Panama policy were introduced.

HAYDEN, FERDINAND VANDEVEER (1829-87), American geologist and physician, born at Westfield, Mass., Sept. 7, 1829. He was graduated from Oberlin College in 1850 and from the Albany Medical College, with an M.S. degree, in 1853. From 1853 until his entry into the Union Army as a surgeon at the outbreak of the Civil War, he conducted geological explorations in the Missouri valley. At the close of the War, he went to the University of Pennsylvania as a professor of geology. In 1866 Hayden made a second exploration expedition to the Missouri valley and the following year conducted surveying operations in the Territory of Nebraska. In 1872 he gave his services to the U.S. Geological Survey and took charge of the survey of territory west of the Mississippi. During these activities he discovered the geysers of the Yellowstone and was instrumental in establishing the National Park there. He died at Philadelphia, Pa., Dec. 22, 1897.

HAYDN, FRANZ JOSEPH (1732-1809), Austrian music composer, was born at Rohrau, Mar. 31, 1732, the son of a wheelwright. He was a choir-boy at the Vienna Cathedral during 1740-50, and received irregular instrumental instruction. His early struggles ended in 1759 when he became conductor of Count Ferdinand Morzin's private band, and in this period he composed a quantity of chamber music. His lifelong connection with the Esterhazy family began in 1761. He conducted Prince Esterhazy's orchestra, and composed for his patron in every form. The prince died in 1790, and Haydn, amply pensioned by his successor, left for London, where he was warmly welcomed. Haydn's unremitting industry resulted in 125 symphonies, 85 string quartets, 19 masses, and 22 operas. He died at Vienna, May 31, 1809.

HAYES, CARLTON JOSEPH HUNTLEY (1882-), American historian and educator, was born in Afton, N.Y., May 16, 1882. He graduated in 1904 at Columbia, where he joined the history department as instructor in 1907 and in 1919 was made a full professor. He is the author of *British Social Politics,* 1913; *Political and Social History of Modern Europe,* 1916; *A Brief History of the Great War,* 1920, and *Essays on Nationalism,* 1926; and coauthor of *These Eventful Years,* and *Ancient and Medieval History.*

HAYES, PATRICK JOSEPH (1867-), American cardinal, was born in New York City, Nov. 20, 1867. He was educated at Manhattan College, St. Joseph's Seminary and at the Catholic University of America, being ordained a priest in 1892. In 1903 he was made chancellor of the archdiocese of New York and until 1914 was president of the Cathedral College, a college he had been instrumental in organizing for young men contemplating becoming priests. His work at the college having brought favorable comment, when it was desired during the World War to organize Catholic army and navy chaplains, he was appointed Catholic Chaplain Bishop of the United States Army and Navy, Nov. 24, 1917, with several hundred priests under him. Later he was a member of the executive committee of the Catholic War Council. On the death in 1918 of Cardinal J. M. FARLEY, he was elected Archbishop of New York, and was soon active in Catholic charities. His ability as an organizer of charity work was commented on by the New York State Board of Charities. From archbishop he was elevated to the cardinalate on Mar. 24, 1924.

HAYES, RUTHERFORD BIRCHARD (1822-93), 19th President of the United States, was born at Delaware, O., Oct. 4, 1822, the third son of Rutherford and Sophia Birchard Hayes. On his father's side he was a descendant of George Hayes, a Scotchman who emigrated to the American colonies about 1680. During the period of his education under the tutelage of a Methodist uncle, who supplied the youth's constant demands for books, he displayed an unusual capacity for study. He attended secondary schools at Norwalk, O., and Middletown, Conn., graduated in 1842 from Kenyon College as valedictorian, and completed the law course at Harvard University in 1845. The same year he was admitted to the Ohio bar, and in 1846 formed a partnership with Ralph P. Buckland at Lower Sandusky (now Fremont).

In failing health, he spent several years in Canada and Texas, returning in 1849 to open law offices in Cincinnati. As his practice grew, he began to take an interest in politics. He had a small share in the first Republican presidential campaign, and during 1858-61 served as City Solicitor of Cincinnati. When war was declared in 1861, he voluntered, and was appointed a major in a volunteer regiment of the 23rd Ohio Infantry. The regiment was ordered to West Virginia for active service, and saw immediate action under McClellan. The following year Hayes was wounded while leading a charge at the battle of South Mountain. He was commissioned a colonel for gallantry under fire, and in 1863, as brigadier-general of the famous Kanawha division, he repulsed the Confederate John Morgan, prevented his force from retreating over the Ohio River, and participated in the raider's capture. Under Gen. Crook he distinguished himself at the battle of Winchester, and in 1865, following repeated evidences of his daring, Hayes was brevetted a major-general. Before demobili-

zation he was nominated for Congress on the Republican ticket, was elected, and was reelected in 1866. As chairman of the Library Committee, Hayes increased the facilities of the Library of Congress, and initiated amendments in the copyright statutes. In 1867 he was nominated for the Ohio governorship, and elected by a generous plurality. His military exploits, combined with his charm of manner, won him an ever-increasing circle of friends. Hayes was reelected to the governorship in 1869, and during his second term launched a state geological survey and materially reduced the public debt. He planned in 1872 to retire from public life, but was persuaded in 1875 to run again for the governorship. He was elected on a "sound money" platform. In 1876 the Ohio Republicans named him as their choice at the forthcoming national convention. His chief competitor was James G. Blaine, whose nomination was made impossible by the number of other regular candidates. As the only man upon whom a majority of delegates could agree, Hayes was finally given the nomination on the 7th ballot. The Democrats nominated Samuel J. Tilden, who was nationally known for his dissolution of the Tweed Ring. The campaign was bitter, and following the election, both parties charged fraud. A commission composed of five Supreme Court justices, five Senators, and five Representatives eventually ruled that Hayes had been elected by a margin of one electoral vote. Accordingly he took office in Mar. 1877.

The President's tact and political sagacity minimized the traditional friction with Congress. He held administration leaders to a policy of pacification toward the South, and by withdrawing Federal troops from southern capitals, lessened hostility to the government in the former Confederate states. In his first year of office he sent Federal troops to preserve order in districts where rioting occurred during the great railroad strike of 1877. He attempted, not altogether successfully, to break up the patronage system, urging competitive examinations in the Civil Service. Most of his reform recommendations angered the politicians whose support had won him the nomination, particularly a New York group, led by Roscoe Conkling. His vigorous fight with these and other members of his party would have prevented his renomination had he desired a second term. Relinquishing his office in 1881, Hayes retired and engaged in numerous educational and philanthropic activities. He died at his home at Fremont, Jan. 17, 1893, of neuralgia of the heart. In 1852 Hayes married Lucy Ware Webb, the mother of his seven sons and one daughter.

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HAY FEVER is an important example of a group of diseases which depend upon the fact that the patient is hypersensitive to some substance in his environment. This substance may be a household dust, such as comes from cats, dogs, feather pillows or floss mattresses; an occupational dust, like wool or cotton in textile workers, wheat flour in bakers; or orris powder in hair dressers. The substance may be a food like eggs, wheat, or milk which cause eczema in young babies, or finally, it may be the pollen of various plants which cause hay fever. In each case the fundamental principle of hypersensitiveness or allergy is the same. Why contact with the foreign substance results sometimes in asthma, sometimes in eczema, and sometimes in hay fever remains unknown.

The *symptoms* of true hay fever occur at definite times of year because the particular plants to which the patients are sensitive bloom at exactly these seasons. The tree season in New England is short, but a small number of persons sneeze and have itchy eyes during those weeks in May when the catkins on the birches, oaks and willows ripen and give off clouds of a fine, yellow, almost invisible pollen. Lawn grass and hay grow everywhere, both in the country and in the city, and the several kinds like timothy, red top, blue grass and orchard grass blossom about the first of June and give off pollen until the middle of July. Large numbers of patients have hay fever in just this season. Weeds become more important in August. In eastern United States, the worst offender is ragweed, a greenish plant varying from one to four feet in height with fern-like leaves and covered with upright spikes which bear a multitude of minute greenish flowers. Ragweed blossoms everywhere along the highways, in dumps, and on all vacant land. It produces pollen in enormous quantities, from the 15th of August until the frost kills it. Other weeds, and other roadside plants, as plantain, pigweed, lambs' quarters and goldenrod are relatively unimportant.

What *causes* the symptoms? Why is it that all persons are exposed to these plants in about the same degree, but that only about 2% of the population develop trouble? The reason is that only certain individuals have the capacity to react in a violent way, that is, to become sensitive to the pollens. These individuals are said to be "allergic." Their "allergy" is frequently inherited. As a result of the reaction capacity, every body cell can react violently when exposed to the particular offending pollen. The blood vessels dilate and fluid is poured out. The eyes and nose are red and watery. There is intense itching. Indigestion, fatigue and debility appear. One third of all patients with hay fever wheeze and complain of shortness of breath when their attack is severe. It is these cases particularly who need treatment so as to forestall the development of pollen asthma. Temporary deafness, dependent upon the chronic congestion of the nose, and resulting in closure of the EUSTACHIAN TUBE, is another complication seen in a few cases.

This same reaction is used in *diagnosis*. When the particular pollen is applied to the patient's skin, an immediate swelling and redness like a mosquito bite results. Such a skin test is "specific." It demonstrates a true hypersensitiveness, although sometimes false positive reactions indicate that other pollens are potential causes of trouble. Normal persons do not react.

The *treatment* of hay fever is satisfactory in about 75% of the cases. It consists in a series of doses of an extract of the offending pollen or pollens. These doses are given hypodermically at intervals of from three to seven days, and ordinarily about a dozen treatments are necessary. In each instance they must be carefully graded to suit the individual patient, for otherwise they will do no good and may do harm. As most of the doses must be given before the season starts, it is clear that the treatment should begin about eight weeks before the time of hay fever. The grass cases should begin in March or April; the ragweed cases in June. Individuals sensitive to both grasses and weeds have double hay fever and usually require double treatment.

In all large cities there are physicians who have the special training and the materials for treating hay fever and preventing its complications. Moreover, the out-patient departments of most of the larger hospitals have special clinics for asthma and hay fever. The treatment is, therefore, available to all. The results are not perfect, but they are much better than the attempts to control the symptoms with various sprays, washes, and ointments applied to the eyes and nose directly. When further study enables us to modify the underlying reaction capacity—the ALLERGY—then the problem will be solved. F. M. RA.

HAYMARKET, a street in London, England, between Piccadilly Circus and PALL MALL, named from the hay and straw market formerly held there; the market was removed in 1830. It is noted for the Haymarket Theatre or Theatre Royal (opened 1720; rebuilt 1821 and again in 1880), which has had distinguished managers, including HENRY FIELDING, Charles Macklin and SIR HERBERT BEERBOHM TREE.

HAYMARKET RIOT, Chicago, May 4, 1886, a momentous clash between authority and anarchy, which discredited revolutionary labor agitation in the United States, and temporarily checked the general movement for the eight-hour day. Many industrial workers of the Chicago area had gone on strike for the eight-hour day, and considerable unrest existed when on May 3 the police dispersed, with unnecessary roughness, a gathering of unemployed men about the McCormick Reaper Works, then employing strike-breakers. At a protest meeting in Haymarket Square on the following evening, Police Inspector John Bonfield appeared with 180 patrolmen and ordered the crowd to disperse. A bomb thrown among the policemen mortally wounded eight men, injuring 67 others. The police then charged the mob, whose casualties remain unknown. Eight anarchists, no one of whom was identified as the bomb-thrower, were convicted as accessories to murder; four of them were hanged, one committed suicide, and three, who were imprisoned, received a pardon from Gov. John P. Altgeld in 1893.

HAYNE, ROBERT YOUNG (1791-1839), American publicist, was born in Colleton District, S.C., Nov. 10, 1791. Educated for the law, he served in the War of 1812, entered the State Legislature in 1814, was State Attorney General 1818-22, and in 1823 became United States Senator. Hayne in the Senate opposed all upward revisions of the tariff and declared a tariff for any other purpose than revenue to be unconstitutional. In 1830, he defended the doctrine of states-rights in a celebrated debate with Daniel Webster. In 1832, he strongly favored nullification by his native state and upon his election as Governor he resigned from the Senate to carry into effect the proposed program of nullification of the national tariff acts in the state of South Carolina. The compromise tariff of 1833 averted the threatened crisis. Hayne completed his term as governor in 1834 and served as Mayor of Charleston, 1836-37. He died at Asheville, N.C., Sept. 24, 1839.

HAY-PAUNCEFOTE TREATY, 1901, an agreement between the United States and Great Britain, annulling the CLAYTON-BULWER TREATY so that the United States could proceed with its plans for the construction of the PANAMA CANAL. Great Britain conceded to the United States the sole right to construct, maintain and police the canal, upon the promise of the United States to maintain its neutrality and to adopt the general policy of England's operation of the SUEZ CANAL. Lord Pauncefote, the British ambassador in Washington, and Secretary of State John Hay were the negotiators.

HAYS, a city northwest of central Kansas, the county seat of Ellis Co. The Union Pacific Railroad and an airport serve the city. Wheat and livestock, and also oil, are products of this region. There are flour mills and grain elevators. Hays is the seat of Fort Hays, Kansas State College and Experiment Station, also St. Joseph's College. General Custer at one time commanded old Fort Hays, now a state monument. William F. Cody, "Buffalo Bill," lived here. Pop. 1920, 3,165; 1930, 4,618.

HAY-SCENTED FERN (*Dennstædtia punctilobula*), a handsome perennial plant native to eastern North America, called also boulder-fern. It occurs most abundantly on open hillsides, growing in clumps. The much-divided thin and delicate leaves are slightly hairy below. When drying the foliage emits a haylike fragrance.

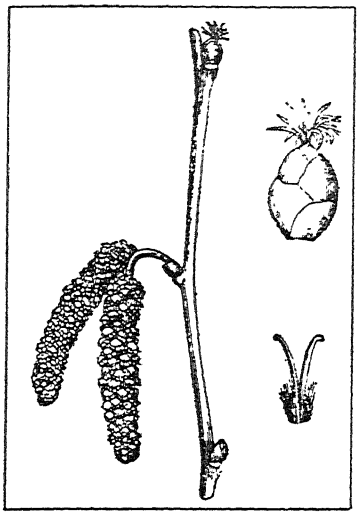
HAYWARD, a city in Alameda Co., western California, 14 mi. south of Oakland, five mi. east of San Francisco Bay. It is served by bus lines and two railroads. Fruit-growing, truck-farming and poultry-raising are the leading interests of the countryside. Hayward is a trade center. Pop. 1920, 3,487; 1930, 5,530.

HAZARD, a city in the coal and hardwood timber region of southeastern Kentucky, the county seat of Perry Co., situated 150 mi. southeast of Lexington; served by the Louisville and Nashville Railroad. Mining and lumbering are the leading interests. Hazard was settled in 1821 and incorporated in 1832. Pop. 1920, 4,348; 1930, 7,021.

HAZE, a slight opaqueness in the atmosphere produced by the presence of dust, smoke or any similar small foreign substances in the air, the limit of

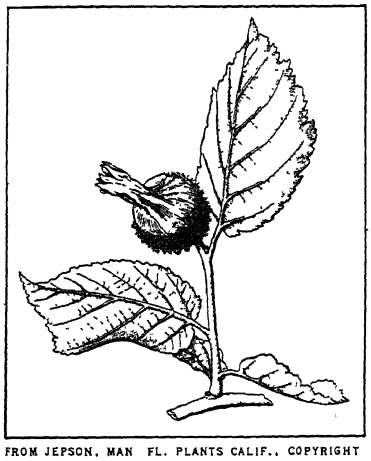
visibility being still about one mile. It is distinguished from a Fog in that it contains no liquid water particles.

HAZEL, a genus (*Corylus*) of shrubs and trees of the birch family, several of which are cultivated



HAZEL
(Corylus Avellana) Branchlet with staminate catkins below and pistillate flowers above, pistillate cluster and single flower (enlarged) right

for their edible nuts and as ornamentals. There are about 15 species native of north temperate regions, three of which are found in North America. The slender branches bear broad, finely toothed leaves, and inconspicuous flowers, the male and female in



FROM JEPSON, MAN FL. PLANTS CALIF., COPYRIGHT

CALIFORNIA HAZEL
Fruiting branchlet

separate clusters, which appear before the leaves. The fruit, a small, hard-shelled nut, is inclosed in a leafy cup or husk, bordered with thin, jagged edges. The common European hazel (*C. Avellana*) yields the filberts or cobnuts of commerce. The Constantinople hazel (*C. Colurna*) and the Lambert hazel (*C. maxima*), both native to Europe, are sparingly grown for their nuts. The native North American hazels, usually slender shrubs a few feet high, are widely distributed, especially northward. The American hazelnut (*C. americana*), which ranges from Maine to Saskatchewan and southward to Florida and Kansas, bears small sweet nuts in husks usually broader than high; the beaked hazelnut (*C. rostrata*), found from Nova Scotia to British Columbia and south to Oregon, Kansas and Georgia, bears similar nuts in a tubular-beaked husk; the closely allied California hazelnut (*C. californica*), with a shorter-beaked husk, sometimes grows 20 ft. high. An east-Asian hazel (*C. chinensis*) attains a height of 120 ft.

HAZLETON, a city of Luzerne Co., eastern Pennsylvania, about 25 mi. south of Wilkes-Barre. Hazleton is served by the Lehigh Valley and the Pennsylvania railways, motor bus lines and an airport. Picturesquely situated in mountainous country about 1,800 ft. above sea level, it is a coal-producing center with important anthracite collieries. It has had a thriving coal industry since 1837. A large electric power plant is located here, and among its manufactured products are textiles, lumber, metals, caskets, silk and knit goods. In 1929 the aggregate of manufacturers was valued at approximately $25,000,000; the retail trade amounted to $17,174,207. The town of Hazleton was founded in 1820, the borough incorporated 36 years later and the city chartered in 1891. The region is rich in historic associations of the Revolution and Indian warfare. Pop. 1920, 32,277; 1930, 36,765.

HAZLITT, WILLIAM (1778-1830), English essayist and critic, was born at Maidstone, Kent, Apr. 10, 1778. He attended the Unitarian College at Hackney, became interested in metaphysics, tried painting and went to London to do portraits. There he met CHARLES LAMB, Leigh Hunt and other literary men, and began to write. His domestic life was unhappy, his temperament difficult, but his genius seemed unhampered by any disturbances. His caustic wit, his philosophy and his admirable style animated the dry bones of criticism, and he became a potent influence in awakening England to her rich literary heritage. Among Hazlitt's many important works are *Characters of Shakespeare's Plays, English Comic Writers, English Poets* and *The Spirit of the Age.* Hazlitt is best remembered for his careful, devoted essays on the Elizabethan poets, especially Shakespeare, and for his prose style. He died at London, Sept. 18, 1930.

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HEAD. Among vertebrate animals the head uniformly contains the brain, the organs of sight, hearing, and usually those of smell and taste—the nose and the mouth. The disproportionate development of the brain in higher animals has caused the dorsal part of the head to increase relatively in size. This changes the facial angle, which is that angle formed by the mid-line of the face and the vertebral column. In the lowest fishes it amounts to only a few degrees, but in man is almost 180 degrees.

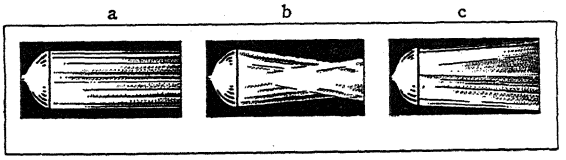
The structures of the head are supported by the SKULL which moves freely on the vertebral column. The articulation between the skull and the first vertebra or atlas allows vertical movements, while that between the first vertebra and the second (axis) allows those in a side-to-side direction.

For arteries supplying structures of the head *see* ARTERIAL SYSTEM; for the veins *see* VEINS. *See also* MUSCULAR SYSTEM; BRAIN; NERVOUS SYSTEM; EYE; EAR; NOSE; MOUTH.

HEADERS, in agriculture, are machines for removing the heads from stalks of grain. The grain header cuts the grain high above the ground and elevates it into a wagon or header barge from which it is stacked and later threshed. This machine is used quite extensively in some parts of the West but is being replaced by the combined harvester-thresher.

HEAD-HUNTING, the practice of decapitating slain enemies and preserving their heads or skulls as trophies. Head-hunting has been practiced at certain periods by people in all parts of the earth, though at the present time it survives only among a few remote and savage tribes. The Dyaks of Borneo are still headhunters, the practice being almost exclusively associated with entering into the estate of manhood. In northern Luzon in the Philippine Islands the Igorots and Negritos practice head-hunting. Likewise the hillmen of Formosa, who show their close relationship to the natives of Borneo and the Philippines in their dress, language and customs. For every Kaja-Kaja native in southern New Guinea, at least one enemy has been beheaded for the purpose of giving him a head-name. The Nagas, Kukis, Tangkhul, and Lusheis of Assam hunt heads to assure health, prosperity and good hunting. The Wa of Burma and the Kagoro, Kajji, Moroa and Attakka tribes of northern Nigeria are also head-hunters. The Jivaro tribes of the mountainous regions of eastern Peru shrink captured heads by means of hot sand forming the well-known *Tsantsas.*

HEADING, in coal mining, a narrow passage driven in the coal as a haulway, airway or manway.



COURTESY WESTINGHOUSE LIGHTING INST.

PARABOLIC REFLECTOR HEADLIGHT

Showing the effect of varying the distance between the bulb and the reflector. The bulb is shown placed (a) *at the focus of the reflector,* (b) *ahead of the focus and* (c) *back of the focus*

The term sometimes is used for a single passageway or for several complementary passageways serving for both haulage and ventilation. In the anthracite region, it is used for a ventilating passageway between two chambers or ROOMS, these being a counter-heading when connected. *See also* MINING, COAL.

HEADLIGHTS, lamps used on vehicles for lighting the way ahead of them. The Interstate Commerce Commission prescribes that the locomotive headlight shall reveal a dark object the size of a man 600 ft. away under conditions of average visibility. In general, state laws require that automobile headlights reveal a similar object 250 ft., also, that they meet the joint specifications of the Society of Automotive Engineers and the Illuminating Engineering Society.

Headlights generally employ an electric incandescent lamp with a concentrated filament and a paraboloidal reflector. For automobiles, normal beam divergence is not sufficient to cover the road, ditches and turns and it is usually increased by refracting prisms in the lens. *See* LIGHT PROJECTION. H. S. B.

HEALTH, PUBLIC. *See* PUBLIC HEALTH.

HEALTH DEPARTMENTS, the administrative units in the state and local governments of the United States which deal with matters pertaining to the public health. The work of the state health departments falls into three categories; the collection and dissemination of information, the examination and licensing of certain classes of practitioners, and active participation in work relating directly to the prevention or eradication of disease. The activties of the municipal health authorities fall for the most part in the last category.

HEALTH EDUCATION, a term which includes all organized activities concerned with preserving or bettering the health of individuals and groups of individuals. Particularly since the World War it has become a prominent feature of educational and civic life. In the schools, health education originated in France in 1833, when the practice of periodic health inspections was instituted. Health education in modern schools covers such a variety of interests as health inspection, hygiene, sanitation, oral hygiene, the treatment of undernourished and tubercular children, outdoor schools, playground and gymnasium work. It is specially emphasized in colleges and universities, where all incoming students are subjected to a rigorous medical examination and are given one, two or more years of physical or military training. In 1926 a regular health examination of school children was required in 42 states, and in 33 states PHYSICAL TRAINING was compulsory. Under health education may be mentioned also such organizations as the U. S. Public Health Service and the health bureaus of various life insurance companies.

HEALTH INSURANCE, a form of insurance which provides for the payment of a weekly income to the policy holder in the event of physical incapacity caused by illness, as well as a death benefit in case of death. While occupational and ordinary illness incapacitates more industrial workers than do accidents the indemnity offered by compensation insurance is limited and in some cases no provisions are made for occupational diseases. Health insurance is a means of relieving this condition. Health indemnity in addition to compensation may be obtained either through health policies or through non-cancellable income policies. Health policies are written with a clause reserving to the company the right to cancel even during the policy term which is usually one year.

However, such cancellation does not prejudice any claim originating prior to cancellation. The company may also refuse to renew the policy when the term expires.

HEALY, GEORGE PETER ALEXANDER (1808-94), American painter, was born in Boston, July 15, 1808. He began to study in Paris in 1836. From 1858 to 1867 he lived in Chicago, then went abroad to live. He painted portraits of Louis Philippe, Marshal Soult, Louis Cass, Clay, Calhoun, Webster, Seward, Pierce, Gen. Sherman, Douglas, Longfellow and many others. He was an honorary member of the National Academy. His *Portrait of the Artist* hangs in the Metropolitan Museum, New York. Healy died at Chicago, June 24, 1894.

HEARING, one of the five senses. Its receptor is the EAR. This sense organ is stimulated by air vibrations which, when registered, give rise to sensations of sound. Sounds may be divided into two main classes, noises and tones. The former are produced by irregular vibrations, while the latter are the product of regular and periodic vibrations. Some 550 different kinds of noises may be distinguished, and pitch discrimination may detect about 11,000 tones. Tones are produced by vibrations ranging from 12-20 and 25 or 30,000 per second. Of these the musical tones range between 60 and 4,000 or 5,000. The rate of vibration determines the pitch of a sound; the amplitude of the wave accounts for its intensity, and the form produces its tone quality. The rate is the frequency or number of vibrations per second, such as middle C being produced by 256 vibrations of a tuning fork. The amplitude is the depth or diametrical swing of the wave. The form is the manner in which the vibrations take place. Thus a violin string may be made to vibrate in thirds, fourths, fifths, etc., while at the same time the entire string may be set in vibration. This fusion of different forms of vibration gives rise to the phenomena of overtones or tone quality of an instrument. It is this tone quality that distinguishes a clarinet from a flute. The cortical center for hearing is in the temporal region particularly the convolutions of the brain adjacent to the Sylvian fissure.

HEARN, LAFCADIO (1850-1904), Anglo-American writer of Japanese life, was born in Leucadia, Greek Ionian Islands, June 27, 1850, the son of Surgeon-Major Charles Hearn and his Greek wife. He attended Ushaw Roman Catholic College at Durham, England, and at 19 came to America. For a time he worked on the *Times-Democrat* in New Orleans, and in 1891 was sent to Japan as a correspondent. Hearn soon broke off his newspaper connection, however, to write of the country in his own way. He taught English at the University of Tokyo, married a Japanese wife, and became a Japanese citizen and a Buddhist under the name, Yakumo Koizumi. He published 12 books, the most notable of them being *Glimpses of Unfamiliar Japan, Out of the East, In Ghostly Japan, Japanese Fairy Tales* and *Japan, an Attempt at Interpretation.* Hearn died in Japan, Sept. 26, 1904.

HEARSAY, in law, testimony of a witness who tells not what he knows personally but what he has heard from others. As a general proposition it is not admissible in evidence in common-law jurisdictions, but there are many exceptions.

HEARST, PHEBE APPERSON (1842-1919), American philanthropist, was born in 1842. At 20 she married George Hearst, U. S. Senator from California and a man of great wealth. Her benevolences included establishing and supporting kindergartens at San Francisco, Washington, D.C., and Lead, S.D.; donations to the American University and National Cathedral School for Girls at Washington and to the University of California; founding of free libraries at Lead, S.D., and Anaconda, Mont. Her son, William Randolph Hearst, gave the Greek Theater at Berkeley, Calif., as a memorial to his mother. Mrs. Hearst died at Pleasanton, Calif., Apr. 13, 1919.

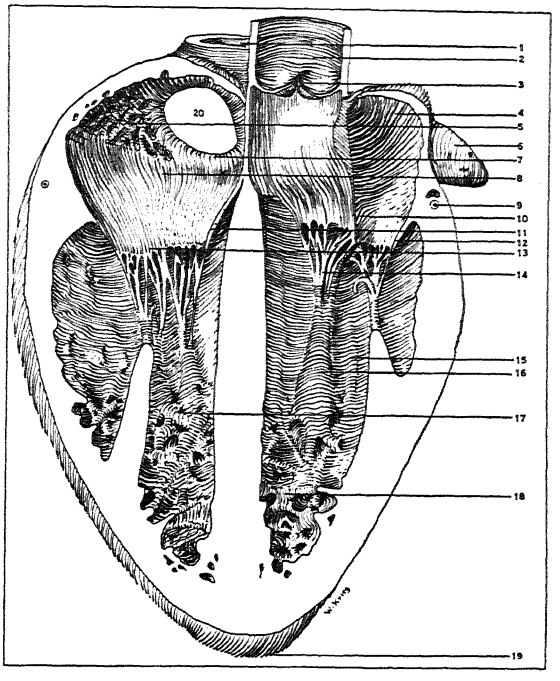
HEARST, WILLIAM RANDOLPH (1863-), American publisher was born in San Francisco in Apr. 1863. He is the son of the late George Hearst, who made an enormous fortune in ranching and mining in California. His mother was Phebe Apperson Hearst. Educated at Harvard, he later studied newspaper publishing and became associated with *The San Francisco Examiner,* obtaining control of it in 1887. In 1895 he came to New York and bought *The Morning Journal,* which he sold for one cent a copy and further popularized by means of sensational news stories, glaring types, and comic supplements. An evening edition appeared in 1896 and achieved a huge circulation. Hearst then established papers in Chicago, Los Angeles, Boston, and Atlanta, introducing the sensational features that had proved so successful with *The Journal.* From 1903 to 1907 he represented a New York district in Congress, his political sympathies being radical. In 1906 he ran as candidate for the governorship of New York state on the Independence League which he had organized. He was defeated at this time and again in 1909, when he ran for mayor of New York City. In addition to his newspapers, Hearst also has large magazine and motion picture interests.

HEART, the hollow muscular organ which pumps the blood through the vessels. The heart is situated in the front part of the chest, between the lungs, and more on the left side than on the right. (For position *see* ARTERIAL SYSTEM, Fig. 1.)

It is divided into four chambers: right and left atria or auricles, and right and left ventricles. The great trunk arteries and veins are connected with these cavities. Fibrous valves are located in the circuit at certain positions, in order that the heart may efficiently carry on its work as a pump.

The blood enters the heart at the right atrium or auricle (*see* accompanying figure, *R.A.*). Blood coming from the upper part of the body gains access through the superior vena cava, while that from below passes through the inferior vena cava (*I.V.C.*), the two opening separately. The entrance of the latter is guarded by a semilunar ridge of tissue, which deflects

the blood upward. This is the valve of the inferior vena cava (*V.I.V.*). Blood coming from the walls of the heart itself enters by a small opening on the wall between right and left auricles. This opening of the coronary sinus (*C.S.*) is guarded below by the Thebesian valve or valve of the coronary sinus. The wall of the right atrium is thin but muscular. On its inner



INTERIOR OF THE HUMAN HEART

1 S.V.C., *superior vena cava;* 2 Ao., *aorta;* 3 Ao.V., *aortic valve;* 4 LA., *left atrium;* 5 M.P., *pectinate muscles;* 6 Aur., *auricula of left atrium;* 7 V.I.V., *valve of inferior vena cava;* 8 R.A., *right atrium;* 9 C.A., *coronary artery;* 10 L.A.V., *left atrio-ventricular opening;* 11 T.V., *tricuspid valve;* 12 B.V., *bicuspid valve;* 13 R.A.V., *right atrio-ventricular opening;* 14 C.T., *chordæ tendinæ;* 15 L.V., *left ventricle;* 16 P.M., *papillary muscles;* 17 R.V., *right ventricle;* 18 T.C., *trabeculæ carnæ;* 19 Ap., *apex;* 20 I.V.C., *inferior vena cava*

wall are strands of muscle which are free at the middle but attached at the ends. These are the musculi pectinati (*M.P.*). The front wall of the atrium is prolonged into a pouch, the auricula or appendix.

Below, the right atrium opens into the right ventricle (*R.V.*). This opening is large enough to admit four fingers and is guarded by a valve with three cusps, the tricuspid valve (*T.V.*). The right ventricle is much larger and thicker walled than the corresponding atrium. Its interior presents a number of strands and columns of muscle, the trabeculae carnae (*T.C.*). In addition, there are two large conical masses of muscle continuous by their bases with the wall of the ventricle. To their apices are attached the fibrous chordae tendinae (*C.T.*) whose other ends are attached to the free edges of the flaps of the tricuspid valve. By this arrangement the flaps are prevented from being forced back into the auricle as the pressure in the ventricle increases with each contraction.

Above and in front, the right ventricle opens into the pulmonary artery. This opening is closed by a valve composed of three cusps, the pulmonary valve, which allows the blood to flow only from the ventricle into the artery.

The blood from the right atrium, after having been forced into the pulmonary artery, is distributed to the lungs. It is aerated in the capillaries of the lungs, collected into veins, which combine into two from each lung, and enters the left atrium (*L.A.*).

The left atrium is quite similar to the right except that the four openings of the pulmonary veins are not provided with valves. The only valve in connection with the left atrium is the left atrioventricular valve, the bicuspid or mitral valve (*B.V.*). As its name suggests the bicuspid valve is composed of only two flaps.

These flaps are connected by their edges to the wall of the left ventricle in a manner identical with that of the flaps of the tricuspid valve. The left atrioventricular opening will admit only two fingers, and the cavity of the left ventricle is somewhat smaller than that of the right side, but its walls are much thicker. Since the left ventricle must furnish the motive power for conducting the blood through all the capillaries of the body except those of the pulmonary circuit, the reason for this difference in strength is evident.

At the upper and front part, but behind the origin of the pulmonary artery from the right ventricle, the left ventricle joins the AORTA. The aortic opening is closed by a valve identical with that at the base of the pulmonary artery. The blood, having passed through the left atrium and left ventricle, is distributed by the branches of the aorta to the various regions of the body (*see* ARTERIAL SYSTEM).

The heart is composed of a special type of MUSCLE, cardiac muscle. Its interior is lined with a single layer of squamous epithelial cells, the endocardium. It is enclosed in a double walled sac, the pericardium, as though it had been held at the base where the great vessels are, and pushed apex first into one side of a closed sac until both sides are in contact. The inner wall of the perpicardial sac has fused with the heart wall, forming the epicardium.

For action of the heart *see* VASCULAR SYSTEM. *See also* HEART DISEASE; ARTERIAL SYSTEM; VENOUS SYSTEM. W. J. S. K.

HEART DISEASE, a term applied to the damage resulting from the action upon the heart of one of several different factors. The type of damage varies with the causative agent. Heart disease may exist for a considerable length of time in an occult stage, and can be discovered by a physician's examination, but gives no suggestion of its presence to the patient. It is most important to discover it in this stage, for it is possible to take measures to stay the progress of the disease and thus postpone the time when it will make itself known to the patient by unpleasant symptoms.

Arteriosclerotic Heart Disease. The commonest heart affection is due to ARTERIOSCLEROSIS. Exceptionally this may cause symptoms between 35 and 40

years of age, occasionally between 40 and 50 years, but usually after this time. It often happens that one branch of the small (coronary) arteries, which supply the blood to the myocardium itself, will be more affected by arteriosclerosis than others. It cannot dilate, as it should, to carry an extra amount of blood when there is need. The muscle supplied by this vessel thus lacks proper nourishment and removal of waste products when the heart is called upon for extra effort, and a pain or discomfort in the chest is felt at such times. This symptom is called ANGINA PECTORIS. It arises on effort or with excitement, and passes off in a few minutes when the effort is stopped. (*See also* ANGINA PECTORIS.)

Muscular Changes. If many of the coronary arteries are affected by arteriosclerosis the muscles will become weakened and, in time, slow degenerative changes will take place. Either before or after this stage, the weakness of the muscle may cause improper functioning and leakage of one of the heart valves and the patient may notice unusual shortness of breath on exertion. Also one or more of the cavities of the heart may undergo *dilatation* and certain portions of the myocardium may increase in thickness (*hypertrophy*) in an effort to compensate for the weakness of other portions.

Myocardial Insufficiency. This condition is an inability of the muscle to carry on a proper rate of circulation to supply the needs of the body. It usually first leads to unusual shortness of breath (dyspnea) on effort, and the more marked the myocardial insufficiency, the more easily shortness of breath is produced, until it may even be present without any effort preceding. At some time during the later stages of this process, swelling may appear in the feet or ankles, called edema, which is lessened by rest in bed. Pressure upon this swelling will leave a depressed area for some minutes after the pressure is removed. Edema may become very extensive, involving the legs, thighs and hips, rarely the hands and forearms. The abdomen may also come to contain fluid, which is called ASCITES.

Thrombosis of Coronary Arteries. When one of the coronary arteries becomes markedly narrowed by arteriosclerosis, the blood may clot at the narrowed region (coronary thrombosis). This stops the flow of blood to the myocardial area from this branch and gives rise to an attack whose severity depends upon the size and importance of the myocardial area affected. With severe attacks there is usually a pain in the chest like that of angina pectoris, great weakness, nausea and vomiting, and sometimes shortness of .breath. Some attacks are accompanied by little pain, however, but by a condition akin to shock. Other attacks may consist of paroxysms of dyspnea. These attacks are often fatal after a few minutes or hours, but just as often the patient recovers and may survive for years. They occasionally appear as the first symptoms of arteriosclerotic heart disease, but usually only after the symptoms of angina, of effort or of cardiac insufficiency have been present for several months or years. (*See also* THROMBOSIS AND EMBOLISM.)

Diabetes, kidney trouble, high blood pressure, and *chronic lead poisoning* sometimes give rise to the arteriosclerotic form of heart disease. When due to these conditions, it does not differ from the arteriosclerotic heart disease which arises spontaneously. (*See also* BLOOD PRESSURE.)

Rheumatic Heart Disease. Rheumatic fever is also a common cause of heart disease, affecting especially the young. Practically every instance of this disease is accompanied by cardiac involvement. It affects the myocardium especially, the endocardium frequently and the pericardium often, giving rise to the rheumatic forms of myocarditis, endocarditis and pericarditis, either one, two, or all three occurring at the same time. It particularly elects those portions of the endocardium which form the mitral and the aortic valves, so that rheumatic endocarditis often causes a valvular disease which persists for years after the rheumatic fever has gone. The myocarditis and pericarditis usually heal without leaving changes of any importance. Besides the acute rheumatic conditions, there is a low-grade, long-continued chronic rheumatic endocarditis, affecting chiefly the valves. There is also a chronic myocarditis and a chronic pericarditis due to rheumatism.

Rheumatic heart disease usually appears before 20 years of age, though it may not do so until 10 or 15 years later. In certain patients, a rheumatic endocarditis may develop so insidiously, without there being any symptoms from the joints or the heart, that it is impossible to say when it first began. In childhood, it usually takes a very severe form at its onset, but not usually so in later life. An acute attack in early life may leave the patient with valvular disease, but this is likely to remain in the occult stage for many years unless a low grade rheumatic condition continues, or marked valvular damage has occurred with hypertrophy and dilatation of the heart.

Symptoms of myocardial insufficiency with shortness of breath and swelling are often present with the acute attack at the beginning of the disease, or may appear later as a result of marked valvular damage. The symptoms of the acute attack may subside and leave the patient quite well. Unless there is repeated activity of the rheumatic process or marked valvular damage, a patient with valvular disease may go for years without symptoms until the processes of age lead to myocardial weakness. Anginal pains are only rarely present with rheumatic heart disease; the typical symptoms are those of myocardial insufficiency. (*See also* RHEUMATIC FEVER.)

Bacterial Endocarditis. Another form of endocarditis is due to recognizable bacteria and is very liable to become grafted upon an old rheumatic process or upon a heart affected by a congenital abnormality. The bacteria enter the blood from bad teeth or tonsils or an infected cut, and grow upon the endocardium of the already diseased heart. This bacterial endocarditis is a very serious complication and

leads to high fever, often with severe chills and sweating. The patient rarely recovers, but the condition is fortunately rare.

Syphilitic Infection. Syphilis gives rise to a considerable number of cases of heart disease. It affects particularly the wall of the aorta, and often causes ANEURYSM of this artery. The disease may extend downward along the aorta to the heart and in so doing may lead to the narrowing or closure of one of the coronary arteries. This will cause anginal symptoms, perhaps the pain on effort or, if a coronary artery becomes closed, death may occur in a severe attack like that resulting from coronary thrombosis.

If the disease extends further downward, it involves the aortic valves, causing aortic insufficiency. This in turn leads to hypertrophy and dilation of the heart and, as the disease usually affects the coronary arteries at the same time as the valves, the myocardium does not receive a proper blood supply, and myocardial insufficiency sets in, first with shortness of breath and perhaps later accompanied by edema.

Diphtheritic Affection. Diphtheria causes a severe acute form of heart disease, a degeneration of the myocardium caused by the toxin of the disease. The symptoms are pallor, and perhaps slow, weak pulse, nausea and vomiting, discomfort or pain over the heart. It is not common, but when it occurs, recovery follows in only about half the cases. This recovery, however, is complete and leaves no trace of the disease. When the condition is less severe, the only manifestation may be an irregularity of the heart beat, which may not be appreciated by the patient.

Congenital Malformation of the Heart. Congenital malformation may also give rise to a form of heart disease. As the fetus is developing before birth, unknown influences may result in the formation of a heart which is not perfect in structure. One or more valves may be defective, unusual openings may allow the blood to follow a wrong course, the formation of the chambers may be imperfect and so on; so that the normal circulation of the blood is prevented. In extreme cases, life cannot continue and the baby dies at birth. In less severe cases the baby may live, though taking on a bluish color, because of the improper circulation of the blood. Milder cases may live through childhood, and a few live even to old age. Some have shortness of breath due to this condition. Others do not and some scarcely show the bluish color due to imperfect circulation of the blood.

Heart Symptoms. Certain sensations referred to the region of the heart by the patient are so very important as to deserve special mention. *Palpitation* is the term applied to the appreciation of the heart beat by the patient. It may be described by him as a sensation of the heart pounding very hard, beating irregularly, pausing for a brief time, beating fast, fluttering and so on. Such sensations are usually due to an irregular heart action or a too rapid heart action, but may be due to an unnatural keenness of the nerves in the chest wall against which the heart strikes at each beat. Palpitation may be a symptom of heart disease, but may also occur when the heart is perfectly normal.

Pain. Pain may be felt over the heart, either aching or sharp stabbing or knifelike. This, like palpitation, may sometimes be a symptom of heart disease, but very often is due to an oversensitivity of the nerves of the chest wall, the heart being quite normal. It may even arise from disturbances in nearby organs, such as the stomach, the colon, and the esophagus. A sense of *pressure* or oppression felt behind the lower part of the breastbone is much more likely to be due to heart disease than is a frank pain.

H. E. B. P.

HEART OF MIDLOTHIAN, THE, a novel by SIR WALTER SCOTT, the second series in the *Tales of My Landlord;* published 1818. The title is significant, the "Heart of Midlothian" having been the common name for the old jail of Edinburgh. The narrative centers around Effie Deans, a peasant girl who has been imprisoned and condemned to the gallows for the murder of her illegitimate child, and her sister, Jeannie—one of the noblest women in fiction—who finally, walking the entire distance from Edinburgh to London, obtains pardon for Effie from the queen. A well-known character is Madge Wildfire.

HEARTSEASE, a name applied to various plants with handsome flowers including the wallflower and lady's-thumb, but especially to the PANSY.

HEAT. When heat is given to a body, some of the energy may increase the thermal agitation (*see* AGITATION, THERMAL) of the molecules and produce a rise in temperature, some may do work against external forces as the body expands, and some may be used in overcoming internal forces and producing a change in state, such as melting or VAPORIZATION. The *total heat* of a body includes not only the heat which is shown by its temperature, but also that which corresponds to its state. Thus the total heat of a gram of ice is less than the total heat of a gram of water at the same temperature.

Although the total heat of a body depends upon its state, i.e., upon its temperature, pressure and whether it is a solid, liquid or vapor, it does not depend upon the processes by which that state was reached. Strictly speaking, the total heat of a body should refer to the heat required to produce its present state, starting from absolute zero (*see* ABSOLUTE TEMPERATURE SCALE). It is customary, however, to compute it from some more accessible temperature, such as 0° C., since in most calculations it is the *change* in total heat that is required. Hence, some authors define the total heat of a vapor at t° C. as the heat required to raise 1 gram of liquid from 0° C. to t° C. and completely vaporize it. To an engineer, the total heat of steam usually means the number of BRITISH THERMAL UNITS required to produce one pound of steam at the designated temperature and pressure, starting with one pound of water at 32° F.

W. W. S.

HEAT CONDUCTIVITY. *See* CONDUCTION OF HEAT.

HEAT CONVECTION. *See* CONVECTION.

HEAT EFFECTS IN CHEMICAL REACTIONS. *See* THERMODYNAMICS, CHEMICAL.

HEAT EXCHANGE EQUIPMENT, a term applied to that class of auxiliary power plant equipment which functions to transfer heat from flue gases to water or air, from steam to water, from water to air and from steam to air. Evaporators, condensers, coolers, cooling towers, economizers, air pre-heaters and feed water heaters come under this classification.

Evaporators are used to distill feed water supplied to BOILERS in order to purify it. They are commercially feasible only in plants where surface condensers are used and their condensate returned to the boilers so that it is only necessary to distill the "make-up" water. According to construction, evaporators are classified as flash, film and submerged types. In the flash type, hot water is injected into a chamber where pressure lower than atmospheric causes vapor to be produced. In the film type the water flows over steam-filled tubes. In the submerged type the water submerges steam-filled tubes.

The vapor produced in evaporators may be condensed in evaporator condensers, using the feed-water to be heated as cooling water, or in feed-water heaters by the cool incoming feed-water. Low-pressure evaporators usually exhaust into open feed-water heaters at nearly atmospheric pressure while the high-pressure types deliver their exhaust to condensers specially provided for the evaporators.

In a recently developed evaporator the heads to which the tubes are attached are solidly anchored and the tubes bend upon heating and expanding, causing the scale to crack and fall off.

Condensers are apparatus used in connection with steam engines and turbines to condense the exhaust steam and increase the mean effective pressure of the machine. Two general types are in use: jet condensers, in which water is sprayed through jets into a chamber filled with steam; and surface condensers, in which water is circulated through the steam chamber in tubes. Jet condensers are classified as low-level and barometric. The low-level type is low enough so that it may be placed below the engine or turbine, the water being removed by a pump. The barometric condenser is sufficiently high to permit the water to drain off by gravity through a water-sealed tail pipe or barometric column.

The surface condenser consists, essentially, of a cast-iron or steel shell and water tubes. The steam is usually admitted through a large opening in the top of the shell. Sometimes the water is passed over the tubes and the steam through them, and in the evaporative type the shell is omitted, the cooling water being evaporated into the atmosphere.

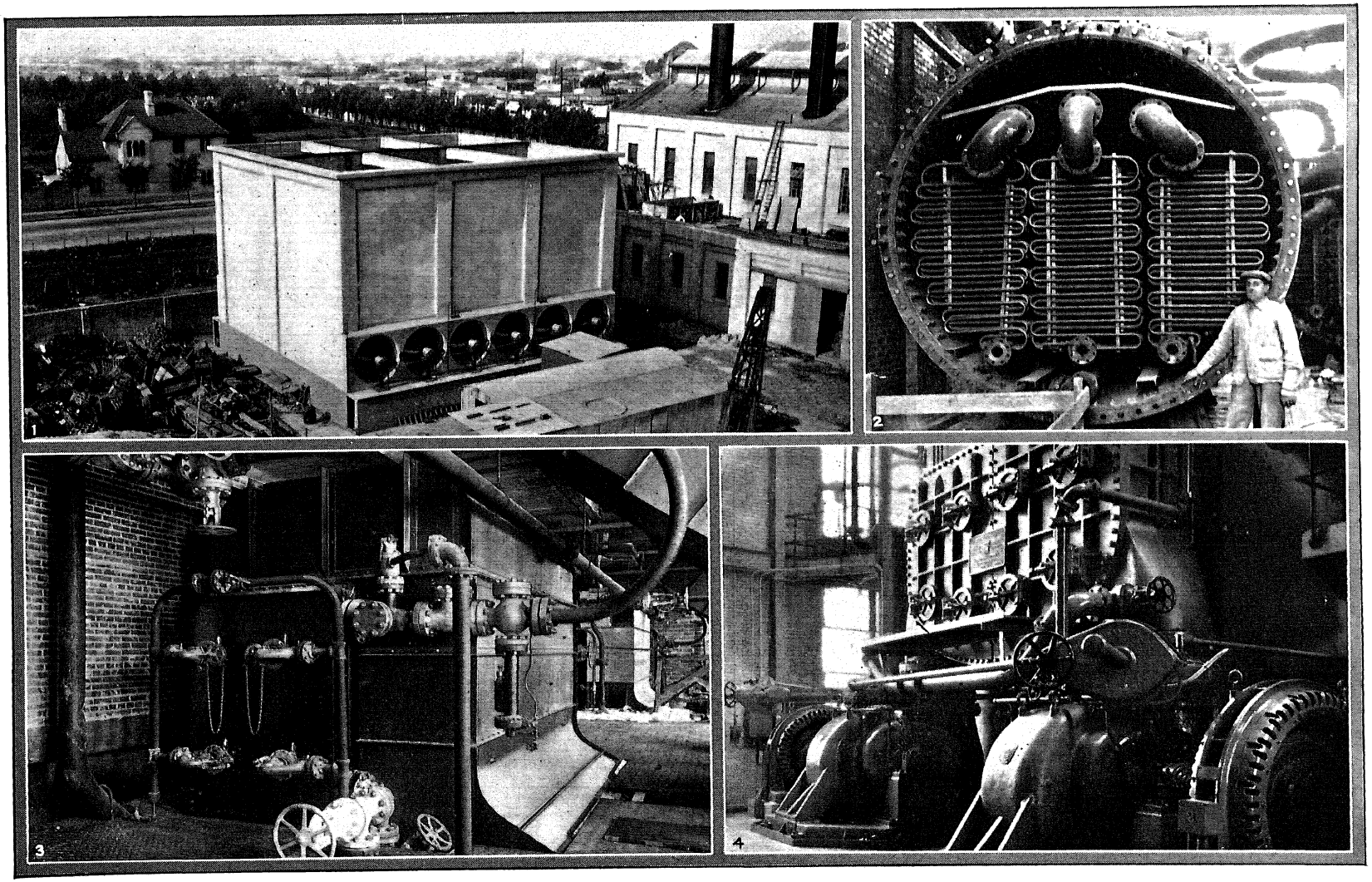
Surface condensers are almost essential in large steam plants and are being built in gigantic sizes. One recently installed with a 115,000 kilowatt turbine had a total surface area of 80,000 square feet and is one of the largest ever constructed.

Cooling towers are structures having a large surface area over which water is circulated to reduce its temperature by contact with the air and by partial evaporation. Cooling towers are built in various types but in all of them water is delivered to the top and allowed to fall in thin sheets or sprays into a tank below. As the water falls, a rising current of air strikes it and produces the cooling-effect. The circulation of air may be maintained by natural DRAFT, forced draft or both. In the case of natural draft a stack is frequently fitted to the top of the tower. In the forced-draft type the sides are entirely enclosed, and fans, usually of the airplane-propeller type, produce the flow of air. The towers may be constructed of non-rusting metal, or of wood, redwood usually being used, and with forced-draft towers the enclosure is frequently of concrete. Cooling towers vary in size from that of the smaller ones used for cooling the circulating water of electrical transformers or internal combustion engines to that of the gigantic structures used for cooling the condenser and cooler water in large refrigerating plants and power stations. *See also* COOLERS; ECONOMIZERS; PRE-HEATERS, AIR; FEED-WATER HEATERS.

HEATH, a numerous genus (*Erica*) of woody plants of the heath family (*Ericaceæ*). There are about 500 species, natives chiefly of South Africa and the Mediterranean region. They are mostly low shrubs, usually ½ to 1 ft. high, but a few are small trees. The bushy stems bear whorled, often minute, three-sided leaves, and numerous small white, rosy or yellow flowers. Among the various species sometimes cultivated under glass in the North or out of doors in the southern states are the cross-leaved heath (*E. Tetralix*), the Cornish heath (*E. vagans*), the Corsican heath (*E. stricta*), the Spanish heath (*E. lusitanica*) and the tree heath (*E. arborea*).

HEATHER, the common name given to several small shrubs of the heath family native to sterile soils in northern Europe. The common heather or ling (*Calluna vulgaria*) is the most widely distributed of all the heaths, extending to the arctic circle in Europe and found also in Greenland and sparingly in Massachusetts. It is a low, much branched shrub bearing minute leaves and narrow clusters of pink or white flowers. This plant is the purple heather of Scotland. The bell heather (*Erica cinerea*), with reddish-purple flowers in very showy clusters, and the crossed-leaved heather (*E. Tetralix*), with the leaves in fours and pink flowers, also cover immense tracts in northwestern Europe, especially in Great Britain.

HEATH HEN (*Tympanuchus cupido cupido*), a large species of grouse closely allied to the prairie chicken. Formerly it was found from southern New England to Maryland, frequenting the scrub oak and pine barrens along the coast, where it fed chiefly upon acorns, but it is now nearly if not quite extinct, occurring only on the island of Martha's Vineyard off the coast of Massachusetts. Its plumage is brownish marked with dusky bars. Like the prairie hen, the male bears a tuft of stiff, pointed feathers and an



COURTESY FOSTER WHEELER CORP.

HEAT EXCHANGE EQUIPMENT

1. Concrete cooling tower in Buenos Aires, Argentina. Each of the six cells is equipped with two propeller type fans for forced draft operation. 2. Close-up of evaporator with the head removed to show the arrangement of tube bundles. 3. Extended surface economizer installed with steam generating units at Lincoln, Nebraska. 4. Surface condenser with pumps, valves and general accessory equipment. This condenser contains 20,500 sq. ft. of heating surface and used 42,000 gallons of cooling water per minute.

inflatable air-sac on the sides of the neck. The heath hen nested in the low growth at the base of a large stump or under a fallen branch, laying creamy buff eggs. But one bird, a male, was known to be living in 1930 and none has been seen since.

HEAT-INDEX, the difference between the light of a star as visually observed and that obtained from the determination of the total amount of heat radiated.

HEATING, CENTRAL AND DISTRICT. The term central heating is sometimes applied, particularly in Europe, to the supply of heat from a central source in an individual building. In United States, it usually refers to the supplying of heat to a group of buildings from a single heating plant, as is done in institutional groups, such as hospitals and universities. The heat is conveyed in the form of steam or hot water—often the latter—through underground pipes. In many of our cities, notably New York, Detroit, Pittsburgh, Rochester, Philadelphia and Boston, there are extensive central systems supplying heat commercially, this form of service being called district heating. Steam is used in these plants almost exclusively, hot water having become obsolete. The central business districts are the most economical field for such a system, and the service is in demand by building owners because it saves floor space and eliminates smoke and dirt from the handling of coal and ashes. The distance over which steam may be transmitted in district heating is great and the heat losses are small, being only from 10 to 20% in properly constructed systems. J. H. W.

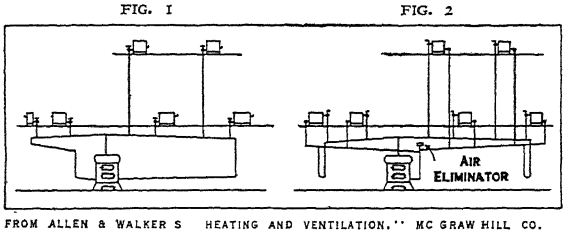
HEATING, ELECTRIC is, in most cases, economically practicable only for incidental and auxiliary heating. The usual heater consists of a resistance coil, which furnishes the heat, and a reflector to project or radiate the heat. A recent development of electric heating system, applied to the entire house, draws electricity only during the night hours when the rates are generally lower, and stores the heat in water contained in tanks. This heated water is circulated through radiators. *See* HEATING, HOT WATER.

HEATING, FAN SYSTEM. In some kinds of buildings, such as schools and theatres, the heating requirements can be readily taken care of by the fan system which also provides the air for VENTILATION, the proper amount of heat being obtained by merely increasing the temperature of the air supply. In industrial buildings, fan systems are frequently used. A recent fan system development is the so-called unit heater, consisting of a steam coil and fan combined as a unit. *See* HEATING OF BUILDINGS; *also* AIR CONDITIONING.

HEATING, GAS, is increasing in popularity due to its convenience. It may be applied to the ordinary heating boiler but is more economical when used in boilers specially designed for the purpose. It is desirable to reduce the heat loss from the building as much as possible by the use of insulating materials, if gas is to be used. Otherwise, this method of heating is not economical. *See also* HEATING OF BUILDINGS; INSULATION, HEAT.

HEATING, HOT WATER is not as widely used in America as in Europe, but it has some advantages from the standpoint of comfort, because of the lower temperature of the radiators. It is usually somewhat more expensive to install than the steam system. The circulation in the hot water system is caused by the lower density of the hot water in the pipes leading to the radiators as compared with the greater density of the cooler water in the pipes returning to the heater. *See also* HEATING OF BUILDINGS.

HEATING, STEAM. The great majority of building in United States, other than small houses, are equipped with some form of steam heating system. The elementary steam system, known as the *one-pipe* system, is shown in Fig. 1. Steam is generated in the boiler and flows through the pipes to the radiators where it condenses, releasing its LATENT HEAT of vaporization. The water of condensation flows back to the BOILER where it is re-evaporated. The air originally in the radiators and piping is forced out through air valves by the pressure of the steam. These valves, when steam reaches them, are closed by a member which changes its shape, or its length, when heated.



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FIG. 1. ONE-PIPE STEAM SYSTEM
FIG. 2. VAPOR SYSTEM OF STEAM HEATING

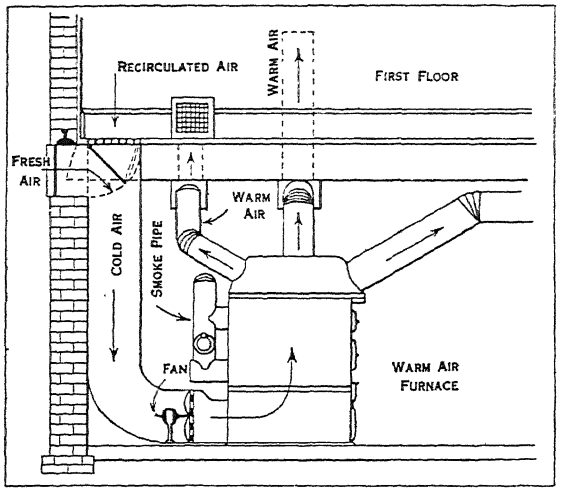
An improved form of the steam heating system is the so called *vapor* system shown in Fig. 2. It derives its name from the fact that it usually operates on a very low steam, or VAPOR PRESSURE, a few ounces above or, in same cases, below atmospheric pressure.

In this system the air and condensate are conducted from the radiators through a separate system of "return" piping. Each radiator is equipped with a thermostatic "trap" which permits the passage of air and condensate but prevents the escape of steam. In large buildings the circulation is improved by the use of a suction pump in the return piping. J. H. W.

HEATING, TEMPERATURE CONTROL OF. From the standpoint of comfort and economy, automatic control of room temperature is desirable with any method of heating. *See* HEATING OF BUILDINGS. Small systems are usually controlled by a THERMOSTAT which closes an electrical circuit actuating a small motor on the furnace damper. In large buildings, thermostats operating the radiator valves by means of compressed air are sometimes used. Another method is to insert an orifice in the supply pipe leading to each radiator and to adjust the steam pressure in accordance with the outside temperature so that the re-

quired amount of steam will be forced through the orifice into the radiator.

HEATING, WARM AIR FURNACE is widely used in small and medium sized houses. It consists of a FURNACE surrounded by a casing forming a passage for the air. Metal ducts carry the warmed air to the various rooms, the circulation being caused



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SCHEMATIC DIAGRAM OF WARM AIR FURNACE

by the difference in weight of the warm air in the pipes and the cooler air without. *See* DRAFT. The circulation may be retarded by restrictions in the ducts if they are not carefully arranged, or by the effect of the wind. A fan is sometimes added to the system to insure more positive circulation, as shown in the figure. *See also* HEATING OF BUILDINGS.

HEATING OF BUILDINGS. In order to maintain the temperature in a building above that of the out-of-doors, it is necessary to supply an amount of heat equal to that which is continually being dissipated from the building. This dissipation consists of three components: 1. Heat loss by conduction through the exposed walls, roof and floors; 2. Heat loss through the window glass; 3. Heat required to warm the air entering the building because of leakage around the window frames as well as that which is purposely drawn in for VENTILATION. The amount of heat passing through various building materials has been determined by experiment, and various insulating materials may be used to lessen this heat flow considerably. *See* INSULATION, HEAT.

The heating of buildings falls into three general classes: 1. Factories and buildings in which manufacturing or industrial operations are being carried on; 2. Office buildings, schools, churches, theaters, hotels and public buildings; and 3. Homes, without relation to size.

Industrial heating usually involves large rooms maintained at relatively low temperatures, say from 50° to 60° F. Frequently it is found desirable to provide humidity control, or AIR CONDITIONING, and definite air movement in view of the nature of the materials being handled, as in cigar and textile factories, where "manufactured weather" becomes important to both quantity and quality of output. *See* HEATING, STEAM. Past practice has been to heat industrial buildings with steam by direct radiation from pipe coils placed around the walls and particularly under the windows. The trend of present practice is to employ unit heaters, usually metal shells containing closely packed steam or hot-water heated pipes made of steel, copper, brass, or aluminum, having an extended surface to increase the rate of heat transfer. *See* HEATING RADIATORS; *also* HEAT EXCHANGE EQUIPMENT. FANS or blowers draw air through the unit, distributing it over comparatively large floor areas. As much as an acre of floor space can be properly heated by a single unit. Large units are of the floor type, and small elements are suspended from the building structure. Self-contained unit heaters are oil- or gas-fired warm-air furnaces and are particularly adapted to foundries, heavy machine shops and plants in which large or rough types of machinery are produced or assembled. *See* HEATING, WARM-AIR FURNACE.

Heating for schools, theaters and churches, as well as for those parts of a factory where a large number of people are employed per unit of space, presents a special problem, because of the heat given off by the human body, as well as the ventilation required. Small "unit" ventilating machines may be placed under the windows; the best practice, however, is the use of a central unit in which air is brought to the proper temperature, either directly in a large warm-air furnace or by passing it over heated radiators, after which it is washed, filtered or dry-cleaned, and brought to the proper degree of humidity. It is then distributed through ducts to the several rooms. It is not necessary to use outside air, as return ducts from the various rooms carry the used air back to the heating plant. In some cases, as in school buildings, OZONE-producing equipment may be used to deodorize the returned air. Fresh-air ventilation of schools through open windows has been discounted by the knowledge that air conditioning provides a uniformity and a quality of air that cannot be attained by natural methods. The comparatively recent application of conditioned air to theaters has been extended to office and similar commercial buildings. The mere supplying of heat and heated air is no longer considered good practice. Steam has been the conventional commercial heating medium, but direct heating of air—combined with complete conditioning and positive circulation—is rapidly supplanting indirect heating by steam or hot water.

Modern domestic heating usually employs a "central" heating plant (*see* HEATING, CENTRAL OR DISTRICT), rather than a stove or fireplace in each room. The earliest form used in the U.S. was the hot-air furnace which has continued almost to the present time as an extremely poor heat-transfer device, averaging perhaps 35% efficiency. Five years ago an experi-

mental residence was erected at the University of Illinois where, under the direction of Prof. A. C. Willard, the warm-air heating plant has been developed to a high degree of efficiency. Largely as the result of this research, modern warm-air heating plants are capable of delivering to a dwelling from 80% to 90% of the heat of the fuel. Warm-air furnaces have been almost doubled in efficiency, and the distribution of air has been made certain and uniform. The use of a fan in the circuit has made it possible to heat even the largest homes with moving air, the fan forcing air to rooms that could not be properly supplied under the old natural-draft circulation systems. *See* DRAFT. Where oil or gas is burned, the fan is connected to the devices controlling the burner and changes its speed with the motor driving the burner. Whereas the old-fashioned hot-air furnaces delivered air to the registers at temperatures often approaching 200° F., the modern warm-air conditioning plants supply a much greater volume of air at a correspondingly lower, and more agreeable temperature. The ability of such plants to provide in the home the three major requisites of an ideal atmosphere—proper temperature, regulated humidity and some degree of air movement —which cannot be obtained with direct steam or water heating systems, promises a rapid shift toward the domestic warm-air conditioning plant. *See* HEATING EQUIPMENT; *also* HEATING, WARM-AIR FURNACE.

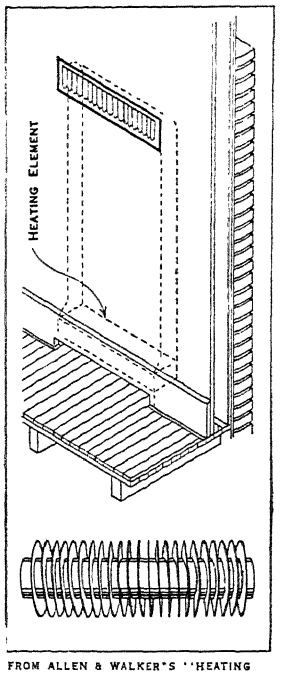
P. E. F.; J. H. W.

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HEATING RADIATORS. The heat-dissipating units in the various rooms are commonly termed radiators; but they actually exchange a large part of their heat (*see* HEAT EXCHANGE EQUIPMENT), not by radiation, but by imparting it to the air currents which pass over their hot surfaces. Concealed heaters of the form shown in the figure are becoming widely used. The heating element consists of a tube wrapped with a helical metal fin which greatly augments the heat-emitting surface. There are many forms of heating elements, the most usual being the cast-iron radiator.

HEAT INSTRUMENTS may be divided into a number of groups according to the purposes for which they are used. The more important groups are the following: Instruments designed to measure temperature, i.e., thermometers (*see* THERMOMETRY) and PYROMETERS of all kinds; instruments for measuring quantity of heat, i.e., calorimeters of all varieties (*see* CALORIMETRY); instruments intended for measuring changes in dimensions produced by change in temperature, i.e., apparatus for measuring the coefficients of expansion, both linear and cubical; instruments for studying transfer of heat and for measuring coefficients of thermal conductivity; instruments for studying change in state and the alterations in physical properties produced by such changes as vaporization and solidification; instruments intended for study of vapor pressures under all conditions; instruments for studying radiation such as RADIOMETERS and radiomicrometers; and instruments for studying the relations between HEAT and other forms of ENERGY. These groups represent merely a rough classification, and many pieces of apparatus might be considered in more than one group. Thus, a device for measuring coefficient of thermal conductivity involves measurement of quantity of heat and temperature, and an apparatus for measuring the mechanical equivalent of heat involves very accurate calorimetry. Also, practically all heat measurements involve some sort of measurement of temperature. Hence, thermometers and other temperature-measuring instruments are of fundamental importance. *See also* THERMOCOUPLES; BOMB CALORIMETER; GAS CALORIMETER.

W. W. S.



FROM ALLEN & WALKER'S "HEATING AND VENTILATION," MCGRAW-HILL CO.

MODERN TYPE OF CONCEALED HEATER

HEAT INSULATION. *See* INSULATION, HEAT.

HEAT STROKE. *See* SUNSTROKE AND HEAT STROKE.

HEAT TREATMENT, METALLURGICAL, term used for operations involving the heating or cooling of a metal or an alloy in the solid state. Broadly, the operations are carried out for the purpose of obtaining certain desirable conditions or properties. Heating and cooling incident to mechanical working processes are not regarded as heat treatment operations. The temperatures, however, although usually above room temperature, may be at or below normal.

Many types of furnaces and baths have been devised to assure proper temperature control and proper atmospheres or other surrounding media. In some cases an oxidizing atmosphere is desired, in others a reducing, and in still others a neutral atmosphere. Steel may be carburized (*see* CARBURIZING) by controlling the temperature, time and atmospheric conditions. An oxidizing atmosphere usually decarburizes an iron-carbon alloy. This is desired in a certain malleableizing heat treatment of white cast iron but it is a result usually to be avoided in the ordinary heat treatment of steel.

Many heat treatment operations involve rapid cooling or quenching. Liquids such as water or oil, solids such as metal shot, or gases such as compressed air, are in use as quenching media.

Annealing is one of the most common heat treat-

ment operations. It usually involves heating followed by relatively slow cooling. The purpose may be to soften, to remove stresses, to refine the "grain," or to produce a definite combination of properties.

Perhaps the best known heat treatment operation is the hardening of steel. When a steel containing more than about 0.50% carbon is heated above its CRITICAL TEMPERATURE range (750-1000° C.) and quenched, it becomes very hard. Reheating below the critical temperature decreases the hardness, the effect in general being greater the higher the temperature and the longer the time. This operation is called "tempering."

The introduction of other alloying elements may change the critical temperatures and also the effect of time at the heat treating temperature as well as the effect of rate of cooling on the final properties.

Industry is constantly demanding closer control of properties and a greater variety of combinations of properties in steel. These conditions have been responsible for many complex alloys and complex heat treatments. Mere hardening heat treatment operations have now become of secondary importance in the steel heat treatment art.

Heat treatment is also important in the non-ferrous metal field. In addition to annealing operations, a number of non-ferrous alloys are now heat treated to increase hardness and strength. A notable non-ferrous alloy amenable to heat treatment is known as duralumin. It contains about 94% aluminum, 4% copper, 0.5% magnesium, the balance being manganese, iron and silicon. When this alloy is wrought and heated to 500° C. and quenched (solution heat treatment), it has a tensile strength of 40,000-45,000 lbs. per sq. in. On standing at room temperature for four days the strength increases to about 60,000 lbs. per sq. in. The change in properties at room temperature is now referred to as aging, or precipitation heat treatment, and it is known that duralumin is one of the few alloys which ages properly at room temperature. Certain other alloys can be quenched from high temperatures and then reheated to certain lower temperatures to produce similar effects. A copper-base alloy, for example, containing nickel and silicon, responds to a similar treatment, the solution heat treatment being at about 900° C. and the precipitation treatment at about 450° C. Z. J.

HEAVISIDE, OLIVER (1850-1925), English physicist, was born at London, May 13, 1850. He began to study the theory of electrical problems in 1874. He published his collected work, *Electrical Papers,* in 1892. In this work appeared his theoretical analysis of problems relating to electrical communication including multiplex telegraphy and the induction between parallel wires. From these theoretical considerations modern long-distance telephony was developed. Heaviside did much work in the study of high-frequency phenomena and advanced the theory of a reflecting non-conducting layer in the upper atmosphere, known as the Heaviside layer. He died at Torquay, Feb. 3, 1925.

HEBE, in Greek mythology, daughter of ZEUS and HERA, was cupbearer to the gods previous to GANYMEDE. As goddess of youth she had the power to restore the aged to their prime. The deified HERCULES was her husband and they were worshiped together at Athens. In Rome she was known as Juventas.

HEBER, REGINALD (1783-1826), English bishop and hymn writer, was born at Malpas, Cheshire, Apr. 21, 1783. He was educated at Brasenose College, Oxford, where his poem, *Palestine,* won a prize. He was ordained in 1807, became prebendary at St. Asaph and preacher of Lincoln's Inn. In 1823 he was appointed Bishop of Calcutta, and remained there until his death. He published a volume of sermons, *A Journey Through India* and *A Life of Jeremy Taylor.* Heber's reputation, however, rests principally on his popular hymns. Among these are *From Greenland's Icy Mountains, Holy, Holy, Holy* and *The Son of God Goes Forth to War.* He died at Trichinopoly, Apr. 3, 1826.

HÉBERT, LOUIS PHILIPPE (1850-1917), Canadian sculptor, was born at Sainte-Sophie d'Halifax, Quebec, Jan. 27, 1850. He studied in Montreal and in Paris, and in 1882 was awarded a prize by the Dominion Government for his statue of Sir Georges Cartier. Other outstanding works were his statues of Mackenzie, MacDonald, and Queen Victoria at Ottawa, the Laval Monument, Quebec, and the Home Monument, Halifax. He died at Westmount, Quebec, June 13, 1917.

HEBREW DRAMA traces its origin to an early period. In the Hebrew Bible one meets with a decided attempt at drama. The Song of Songs belongs to that category, while the Book of Job is claimed to be a Greek tragedy composed in Hebrew, modeled after Euripides. But the Hebrew drama proper did not come to its full development until the Jews found themselves relatively free from persecution, though they produced a considerable quantity of dramatic literature in other languages. In the middle of the 17th century the drama was reintroduced into Hebrew literature, and since the 18th century many translations of dramas written in other languages have been rendered into the Hebrew tongue. Until the beginning of the present century Hebrew drama was mostly allegorical in character, devoid of emotion and of direct presentation of life outside of the individual. In recent decades, while Hebrew dramatists are not very prolific, their productions rival in quality the best of their kind in other languages.

See A. S. Waldstein, *The Evolution of Modern Hebrew Literature,* 1916.

HEBREW LANGUAGE, the original language of the canonical Old Testament. It belongs to the SEMITIC linguistic family and to the CANAANITE group, which here finds its highest and most developed expression.

The Hebrew phonological system, except for gutturals, is more akin to ACCADIAN than to ARABIC, being marked by coalescence of several of the Proto-

Semitic velars, dentals and sibilants, and as in ARAMAIC the letters *b, g, d, k, p, t* have both an aspirated and an unaspirated pronunciation. The verb-stems are divided into three groups: I simple, I_1 passive or reflexive (prefixed *n*), II intensive (duplication of the second radical), II_1 passive (change of vowels), II_2 reflexive (prefixed *ht*), III causative (prefixed *h* and insertion of *i* between the second and third radical), III_1 passive (change of vowels). The monotony of the tenses (completed and incompleted action; cf. TENSE); ASPECT is greatly relieved by the frequent use of the "waw-consecutive" which enables the speaker to start with the perfect and proceed in the imperfect, and vice versa. The case-endings, except for a few, and those highly doubtful, are lost. Mishnaic Hebrew differs from Biblical particularly in the deterioration of the gutturals, the use of the tenses, the mode of expressing the genitive, and the vocabulary, the two latter perhaps more or less due to the influence of Aramaic. It discarded the use of the "waw-consecutive," but developed and extended constructions which were rare or unknown in the classical period, such as a present tense expressed by the participle, and the use of an auxiliary verb "to be." Except for the growth of a new vocabulary, Modern Hebrew, as now spoken in Palestine, differs but slightly from the old.

I. M.

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HEBREW LITERATURE, strictly speaking, denotes all works written in the Hebrew language from earliest times to the present day. In common usage, it is often synonymous with Jewish literature, a term that includes works written by Jews in Hebrew characters, though the language be Aramaic, Arabic, or any other vernacular, and works on Jewish subjects written in the scripts and tongues of other nations.

OLD TESTAMENT

At the head of Hebrew literature stands the Old Testament, a collection of books of various dates and periods. The traditional Jewish view is that the Pentateuch comprising the first part of the collection was written wholly by Moses, which would make these books the earliest Hebrew literature. Modern scholars, however, hold other views, and the documentary theory considers the Pentateuch a composite of several documents, the earliest of which dates from the 8th century B.C. and is contemporaneous with some of the prophetic books. (*See* BIBLE: OLD TESTAMENT.) According to the Jewish Canon, the Old Testament contains twenty-four books, some collections of smaller books being counted as one book, e.g., twelve minor prophets. The three traditional Jewish divisions of the Canon are 1. Pentateuch, or five books of Moses; 2. Prophets, including the historical books, Joshua, Judges, Samuel I and II, Kings I and II, and the prophetic books proper; 3. Hagiographa, or *Ketubim,* including Psalms, Proverbs, Job, Daniel, the Five Scrolls and the historical books, Ezra-Nehemiah and Chronicles. The Septuagint followed by later translations divided the Canon according to the literary character of its parts, viz., legal, historical, poetic and prophetic books.

POST-BIBLICAL LITERATURE (*Ancient Period*)

Apocryphal and Apocalyptic Books. With the close of the Biblical Canon, the production of books similar in nature to those included in the Bible did not cease. In fact, much of this type of literature was written even before the close of the Canon, but for some reason was excluded from it. These books written before and after are called Apocrypha, from the Greek *ἀπόκρυφος,* i.e., hidden away or secret, an appellation given to them because of their exclusion from the Canon and their mystic or exotic character. Allied with the Apocrypha is the Apocalyptic group of books which, as its name shows (from the Greek *ἀποκάλυψις* revelation), deals primarily with revealed things.

The productive period of this kind of literature lasted from 200 B.C. to 100 A.D. The Apocrypha contain books of different types: historical, moral-fiction, prophetic, poetic and didactic. The Apocalyptic books are primarily of the prophetic type. Most of these were in Hebrew or Aramaic, but some were written in Greek. The original texts, however, were lost, with the exception of a portion of *Ben Sira* recently recovered, and an Aramaic fragment of the *Testament of the Twelve Patriarchs.* The books exist today in Greek, Ethiopic, Arabic and Slavonic translations. *See* APOCRYPHA; APOCALYPSE.

Targumim. When Hebrew ceased to be a spoken language (during the Second Commonwealth), a need arose for translations of the text of the Bible into the vernacular Aramaic. These translations were at first given orally in the synagogues, and contained exegetical and often homiletical matter. A number of translations, differing from each other in content, were current for centuries. Much later, they were put into writing and were called *Targumim,* from the Aramaic *targem,* to translate. Three versions of the Targum to the Pentateuch occur. 1. *Targum Onkelos,* the standard translation ascribed to Onkelos, the proselyte, was originally completed (c. 100-130) at Jamnia, Palestine, under the direction of the heads of the schools of rabbis Eliezer, Joshua and Akiba. Later it was transported to Babylonia where there was great need for a translation. There the *Targum Onkelos* was improved and even called "Our Targum." 2. The *Jerusalem Targum,* named "pseudo-Jonathan," is a pure Palestinian version compiled in its present form at about the end of the 7th century, but the material therein is of an earlier date. It contains large elements of Agadic embellishment together with Halachic, or legal, matter which does not agree with standard views. 3. The *Fragmentary Jerusalem Targum* is only another partial recension of the main Palestinian version.

The standard Targum to the prophetic books from Joshua to Malachi is the *Targum Jonathan* ascribed to Jonathan ben Uziel (c. 30 A.D.), a disciple of Hillel. Actually this was compiled in the academies of Palestine about the end of the 2nd century in the manner and spirit of Onkelos and, like the *Targum Onkelos,* was finally edited in Babylonia. Jonathan is not as literal as Onkelos, but is freer in rendering and in the incorporation of Agadic elements. The Hagiographa have Targumim to Psalms, Proverbs, Job, Chronicles and the Five Scrolls; Daniel, Ezra and Nehemiah have no Aramaic versions. Some of these versions are of early and some of later origin. Esther has also a second Targum consisting of legends and stories.

Halacha. Besides the literary activities mentioned, there arose in Israel, beginning with the 4th century B.C., another kind of spiritual activity: the interpretation of the law. The law of the Pentateuch is brief and cannot be applied literally to all phases of life. Tradition (Aboth 1: 1) has it that an oral as well as a written law was given to Moses on Mount Sinai. This he transmitted to Joshua, he to the elders, and they in turn to the prophets, and these again to the men of the Great Assembly. In the days after Ezra, the men of the Great Assembly, or rather the *Sopherim,* viz., scribes, who formed a section of the group, began the expounding and interpretation of the law, unfolding the meaning of the verses containing the laws and thus amplifying and applying them to an expanded religious life. The method used by the Sopherim was called *Midrash,* from *darosh,* to search or investigate. Each verse was scrutinized, analyzed and interpreted. Thus the law became fuller and its application wider. In time, the interpretations multiplied, laws amplified, and the mere transmission of the legal statements alone began to prevail. This was called *Halacha,* from *halach,* to go; viz., a rule of conduct. The term ultimately embraced the entire legal study of the oral law.

The period of the Sopherim terminated with Simon the Just, probably Simon II (c. 200 B.C.). He was followed by a succession of *Zugoth,* or pairs of scholars, who are represented as the heads of the *Sanhedrin,* or highest court, terminating with Hillel (d. 10 A.D.) and Shamai. Hillel gave fresh impetus to the study of oral law by establishing seven rules for its interpretation. His disciple, Johanan ben Zakkai, was the first of the generations of the *Tanaaim,* i.e., teachers, from the Aramaic *tnē,* to teach. These continued to amplify the oral law by Hillel's rules and also organized the mass of *Halakoth,* or legal statements. Because of the oral character of the teaching, divisions arose and schools formed, of which the most noted was that of Hillel and Shamai. The leading Tanaaim were Johanan himself, Eliezer, son of Hyrkanos, Joshua ben Hanania, Akiba, Ishmael and the disciples of Akiba, Meir, Judah, Simon and Josē.

Agada. The oral teaching was not limited to Halacha. It also included instruction in views, opinions and ethics as well as stories and folk embellishments of the lives of Biblical heroes and episodes in history. These teachings bear the name *Agada,* from the Hebrew *haged,* to say or to impart instruction. Like Halacha, Agada clusters round the Bible. The sages interpreted the Biblical text by the same method used in Halacha, viz., Midrash. In time this term came to be applied to books of collections of Agadic statements. Agada is of two types: legendary-historical and religious-ethical. A great deal bearing the character of the first type was preserved in the Apocryphal books, in the Targumim and in separate books. Of such historical-Agadic books, there are two; the first is the *Roll of Feasts and Fasts* (*Megillath Taanit*), which contains a record of special days to be celebrated as minor feasts and of special fast days, both commemorating certain events in Jewish history, together with a brief narrative of these events. The second, called the *Seder Olam,* or *The Order of the World,* is ascribed to Josē ben Halafta (130-160), a disciple of Akiba. The Agada of the second type, like Halacha, continued to be taught orally, and in time swelled in volume. When the temple was destroyed and suffering increased, Agada undertook to comfort the populace by drawing glorious pictures of the Messiah and Messianic times, and aimed to inculcate patience and elevate the spiritual life of the people. Ultimately Agada included all elements by illustrating its teaching with stories, proverbs and legends. Not until later, when the accumulated mass of teachings became too complicated for memory, was Agada written down.

The Mishnah. As the oral law became more complex, it had to be systematized and made fixed. Some attempts were begun by rabbis Ishmael, Judah and Simon, the colleague and disciples of Akiba respectively, to compile Halachic Midrashim on various books of the Pentateuch. These Midrashim were collections of legal statements derived from the verses of these books by the method of interpretation known as Midrash. Ishmael compiled the *Mekilta* on Exodus, Judah the *Sifrah* on Leviticus, and Simon the *Sifrē* to Numbers and Deuteronomy. These Midrashim also contained Agadic parts. The great work was done by Judah ha-Nasi (c. 210), who compiled a standard text-book and a code of the entire Halacha called *Mishnah,* from the Hebrew *shanah,* to learn. It covers the entire range of law and also some of the principal teachings. Hence it contains a small part of Agada.

Mishnah is divided into six orders, each covering a certain part of Jewish law. The orders are subdivided into treatises, called *Massekoth,* i.e., web, a text, and each treatise into chapters (Hebrew *perek,* a link) and each chapter into sections. The orders are 1. *Zeraim,* or seeds, covering all agricultural laws; 2. *Moed,* laws of the Sabbath and holidays; 3. *Nashim,* family law; 4. *Nezikin,* dealing with civil and criminal laws; 5. *Kadashim,* i.e., holy things, laws of sacrifices, temple service and diet; 6. *Taharoth,* laws of purity and impurity. Judah ha-Nasi drew upon earlier individual collections, especially those of Akiba and rabbi Meir. The material Judah rejected or omitted

was later collected under the titles *Tosefta,* or additions, and *Baraiata,* viz., extraneous matter.

Talmud and Agadic Collections. The compilation of the Mishnah gave fresh impetus to the study of the law. Henceforth the Mishnah became the center of discussion in the schools at the two centers, Palestine and Babylonia. The scholars who expounded the Mishnah were called *Amoraim,* i.e., commentators and interpreters. There were five generations of Amoraim in Palestine and seven in Babylonia. The result of this discussion which accumulated during the centuries is the *Gemara,* a commentary on the Mishnah, which together with the Mishnah is called the *Talmud.* The Talmud is found in two versions, the Babylonian and Palestinian. The latter was completed about 425 by Josē, the son of Bun; the former was begun by Ashi (352-427) and completed by his successors in 500. Both versions follow the order of the Mishnah, but the Gemara to some of the treatises is missing. The Babylonian has Gemara to thirty-seven treatises of the Mishnah and the Palestinian to thirty-nine. The Palestinian Talmud is of smaller quantity, poorly edited and written in the West Aramaic dialect; the more extensive Babylonian is well-edited and written in the East Aramaic dialect. Agada occupied one-third of the Babylonian Talmud and one-sixth of the Palestinian.

About the time the Talmud was compiled, a movement got under way to collect and write down the scattered Agada. The work lasted several centuries, some of the Agadic books being dated as late as the 12th century. The usual name for the collections is *Midrashim;* there are now three cycles of these. To the first belong the Midrashim known as *Rabboth,* i.e., large, on the five books of Moses and the five scrolls which range from various dates. The oldest scrolls are *Bereshit Rabba* (on Genesis) and *Ekah Rabba* (on Lamentations), of the 6th and 7th centuries respectively. The other three, *Shemoth Rabba* (Exodus), *Debarim Rabba* (on Deuteronomy), and *Bamidbar Rabba* (on Numbers), date from the 8th, 9th and 12th centuries. The second cycle is the *Tanhuma Midrashim* arranged on the sections of the Pentateuch. Several versions of these occur: 1. *Yelamdenu,* older Midrashim of which a few fragments exist; 2. Printed Tanhuma (middle of 9th century); 3. Manuscript Tanhuma, edited by S. Buber (end of 9th century). The third cycle is the *Pesiqta* arranged on the special portions read on feast days. Of the Pesiqta, there are 1. *Pesiqta Di Rabba Kahana,* end of 7th century; and 2. *Pesiqta Rabbati,* larger in content and dating from the middle of the 9th century. Two more books of an ethical character appear: *Pirqe Di Rabbi Eliezer,* 8th century, and *Tanna Debē Eliyahu,* end of the 10th century. There are also several Midrashim to other books of the Bible, viz., to Psalms, Proverbs and Samuel. In addition, two later collections were made: the *Yalkut Shemoeni* compiled by Simon Karo (13th century) on the entire Bible, and the *Yalkut Mekiri* on Prophets, Proverbs and Job. Finally, there is a host of smaller Midrashim collected by various scholars. The best of these is the *Ozar Midrashim,* compiled by J. D. Eisenstein. In all the above works, the contents as a rule are old, although the date of collection may be later.

MEDIEVAL PERIOD

The Medieval period extending from the 6th to the 18th century was exceptionally productive in literary activity. Its main characteristics were heterogeneity and individuality. The literature of the first period was homogenous, primarily religious and centered round the Bible. It had one or two centers and always retained a peculiar national character. The literature of the second period had secular branches and many centers. It had to reflect the life of the environment, hence its heterogeneity. Besides rabbinics, there arose the study of the law, grammar, lexicography, exegesis, poetry, philosophy, mysticism, history and science. Literature thus ramified and spread in all directions. The work of the first period was chiefly produced in mass and had an anonymous character. That of the second consisted largely of individual productions which bore the names of the authors.

Hebrew Philology and Bible Exegesis. The great works of the ancient period, the Talmud and Midrashim, were written in the mixed Hebrew-Aramaic dialect. But the 7th century saw a revival, and works thenceforth were written in pure Hebrew. In addition, there began a movement to cultivate the science of the language and develop its literature. The first step was the standardization of the Biblical text. This was known as the *Masorah,* from *masor,* to traduce. The work is still an anonymous one and was originally oral. For ages certain scholars devoted themselves to guarding the text of the Bible by marking the changes in the meaning and spelling of words. As the Hebrew Bible was a consonantal text without vowels or accents, they also noted the pronunciation. The work of these scholars began to be put in writing at about the 7th century. For several centuries the Massorites watched every change in the words of the Bible, invented a system of vowels and accents, counted the deviations and numbered the times they were found in the Bible. The result of this was the fixed Masoretic text. Vowels and accents not only facilitated reading, but also served as a commentary. The work of the Masorah was carried on in notes on the margin of the Bible text. There were two versions of these notes: a short one, *Masorah Parva,* and a longer one, *Masorah Magna.* Both were in separate books. The last Masorites were Aaron ben Asher (10th century) of Tiberias, and Naphtali of Babylonia, who seemed to have closed the Masoretic work.

With the standardization of the text of the Bible, a great activity followed in the study of Hebrew grammar, which was carried on in many lands. The Massorite Aaron ben Asher wrote a book on accents; Saadia ben Joseph Gaon (892-942) of Babylonia, wrote the first Hebrew dictionary, *Agron,* and the first scientific grammar, *The Book of the Language,* which laid the foundation of the grammatical science. Somewhat

earlier, about 900, Judah Ibn Koreisch produced a work on the relationship of Hebrew to other Semitic languages. With the decline of the schools of Babylon, Jewish scholarship was transplanted to Spanish soil. There Menahem ben Saruk (910-970) compiled his large Hebrew dictionary, *Machbereth,* to which a short grammar was prefixed. His colleague, Dunash ben Labrat, wrote responsa against him and added his share to the science. The 11th century produced two great grammarians, Judah Ibn Hayyuj and Jonah Ibn Jannah (990-1050). The first laid down in several works the structure of grammar, outlined the conjugations, gave the rules of punctuation, and established the triliteral theory of Hebrew roots, i.e., every root must have three letters. The second, in his book, *Rikmah,* completed the structure, developed the syntax and wrote a lexicon. These scholars were followed by numerous writers of whom the following deserve notice: Abraham Ibn Ezra (1088-1167), who carried the science of languages into Provence and Italy and who wrote five grammar books in Hebrew; and Joseph and David Kimhi (1160-1235), of Provence. The work of the last, the *Michlol,* was complete, summed up all that had been written on grammar and thus became the standard book. However, many authors in Provence and Italy still continued to write grammars. Elijah Levita (c. 1504) is worthy of special mention. He wrote books on grammar, a key to the Massorah (*Masoreth ha-Masora*), and a dictionary of the Targumim, the *Meturgamen.*

The study of the Hebrew language was in the main subservient to the exegesis of the Bible. In general, there were two methods, one based on the plain meaning of words in accordance with the principles of the science of language. This was known as *Peshat* and was cultivated in Babylonia and Spain. The other was called *Derash,* i.e., homiletic employed in France and Germany. In time, the second method was modified and became a mixture of Peshat and Derash. Peshat was initiated by Saadia, who wrote commentaries in Arabic, and was carried on by numerous commentators in Spain, notable among whom were Judah Ibn Balaam and Moses Gikatilia. The greatest of these commentators was Abraham Ibn Ezra, who commented almost the entire Bible in Hebrew and was the best expositor of the Peshat. The greatest representative of the Franco-German commentators was Solomon ben Isaac (1040-1105) known as *Rashi* (from the initials of three Hebrew words, Rabbi Solomon Yitzhaki). With remarkable lucidity he penetrated into the spirit of the Scriptures. Rashi followed to a great extent the Agadic method, but paid attention to grammar and the plain meaning of words. His commentary became the standard because of its excellent qualities of style and genuine Jewish spirit. Of the later commentators may be mentioned Samuel ben Meir (1085-1160), grandson of Rashi, who commented the Pentateuch in a manner closely following the Peshat; Moses ben Nachman (1195-1271), whose Pentateuch commentary, though tinged with mysticism, was a remarkable example of exegesis inasmuch as the writer displayed in it a fine sense for the meaning of words and verses; and Levi ben Gerson who commented the Pentateuch and a number of the other books of the Bible. Levi was the exponent of philosophical exegesis which endeavored to harmonize the teachings of the Bible with those of philosophy. With the entry of mysticism (*Kabbala*) in Jewish life came a number of mystic commentators. Of the later exegetes, Don Isaac Abravanel (1437-1508), deserves notice. His work on the entire Bible was more of an exposition than a commentary, as he undertook to remove all difficulties in the text. He was the first to devote attention to the historical side of the Bible, and he contributed valuable introductions to the books.

Poetry. As a direct result of the revival, poetry bloomed in Hebrew literature. It was not unknown in Israel and was frequently found in the Bible. In later times, however, poetry had its main source in liturgy which underwent a gradual development. In times of the second temple, only the *Shema* (Deut. 6: 4-10; 11: 13-22; Numbers 15: 37-41) and a few benedictions were recited, but after the destruction of the temple, these benedictions were increased to the number of eighteen, called *Shmonah Esrē.* Later, more prayers were added, some of them being of a poetic nature. When the liturgy was standardized about the middle of the 9th century, it was given the name *Seder,* viz., order of prayers. Simultaneously, there arose sacred poets who adorned the liturgy with poems giving vent to deep religious emotions and the sufferings of the people. This sacred poetry was called *Piyyut,* related to the Greek *poeteria.* The first Payyetanim were Palestinians, among whom the most famous and prolific was Eliezer ha-Kalir (end of the 7th century). He was followed by Italian, French and German poets, and in each generation for centuries several noteworthy singers appeared. These included Meshulam, son of Kalonymos; Kalonymos, son of Meshulam (c. 1000); Simon ben Isaac (c. 1020); and Meir ben Isaac, the cantor (d. 1060). The Piyyutim used the Alpha-Beth and name acrostics, but no meter.

Hebrew poetry attained greater heights in Spain and flourished under Arab influence. During the Golden Period (950-1200), a wealth of sacred and secular poetry was produced. The language was pure, and both rhyme and meter were used. Poets were produced who were great as both sacred and secular singers. Among them were Samuel Ibn Nagrila (993-1055), Solomon Ibn Gabirol (1021-52), Isaac Ibn Giath (1030-89), Judah ha-Levi, a distinguished national poet (1080-1140), and Abraham Ibn Ezra. A host of other poets followed and rose to great heights during the later period. Two of the foremost were Immanuel Di Romi (1265-1330), an Italian secular poet whose work breathes the spirit of the early Renaissance, and Israel Najara (b. 1560), a religious poet.

Rabbinics. The close of the Talmud, like the compilation of the Mishnah, served as an impetus for further study of the law. The scholars following

the Talmudic period were called *Gaonim,* and the period from 689 to 1038 the Gaonic Period. The Gaonim were the heads of the academies of Sura and Pumbedita to whom the Jews of other lands turned for instruction. They standardized the Talmud, later began to expound it and to write commentaries and responsa to inquiries from all parts of Jewry. The first literary production of the Gaonim were the responsa of which there are a number of collections. These deal with explanations of the Talmud and render decisions in legal cases. When a need for codes arose, the Gaonim composed them, as the Talmud was not a code in the proper sense of the word. Important among them were the *Sheiltoth,* by Ahai Gaon (748-760), and the *Halakoth Gedoloth,* by Simon Caro. Other Gaonim wrote short commentaries, notably Saadia, Sherira (920-1000), and Sherira's son, Hai (969-1038). Sherira wrote a letter giving the history of tradition and of the Talmud.

With the end of the Gaonic period, many centers of learning sprang up in North Africa, Spain, France, Germany, Italy, and later in Poland. Each contributed to Rabbinic literature. In general the literature followed along three lines: commentaries to the Talmud, codes and responsa. The most important of a long line of commentators were rabbis Nisim and Hananel, in North Africa, who commented briefly on a large part of the Talmud; Moses ben Maimon (1135-1205) who wrote a logical and lucid commentary to the Mishnah in Arabic, later translated into Hebrew; Gershon ben Judah, the "Light of the Exile," and his disciples. The greatest of them all, however, was Rashi, whose extensive commentary threw open the portals of the Talmud to all students. The successors of Rashi delved deeper into the mysteries of Halacha and produced many glosses and novellae throwing new light on the Talmud. These were called *Tosofoth,* or additions, and were a product of a hundred and fifty years of scholarly activity. Among the leading Tosafists were Jacob Tam (1095-1171), grandson of Rashi, and Isaac ben Samuel of Dampierre.

Code-making was a difficult task in Jewry, for as customs increased, opinions were divided and views differed. Codifier after codifier tried his hand at the task. The leading codes were the *Compendium of the Talmud,* by Isaac Al-Fasi (1013-1103); the *Code of Maimonides* (*Mishnah Torah*), a masterly abstract of the entire oral law; the *Compendium* of Asher ben Jehiel (1250-1328); the *Tur,* by his son Jacob; and the final code, the *Shulchan Aruk,* i.e., *The Set Table,* by Joseph Caro. This last included the opinions of predecessors, and became the standard code when it was completed with glosses by Moses Iserles (1520-72), of Poland. In addition, there were hundreds of collections of responsa written by scholars of all countries.

Karaites. In the middle of the 8th century a schism arose in Israel. Anan ben David (745-775) founded a sect known as *Karaites,* who rejected the Talmud in favor of the Bible. This necessitated a new interpretation, and the scholars of the sect produced a literature of their own. It consisted chiefly of exegetical works, books of precepts (*Siphrē-Mitzvoth*) in which the scholars tried to interpret the Bible and form a code of action, and finally some books on philosophy. The important Karaite writers were Anan ben David, who wrote a book of precepts; Benjamin Al-Nehavendi, philosopher and commentator of the Bible; Jacob Al-Kirkisani (10th century), historian, commentator and writer on law; Yephet ben Ali (end of 10th century), a great exegete; and Joseph Al-Basir, the distinguished Karaite philosopher. In the 12th century, Judah ha-Dasi of Constantinople contributed the *Eshkol ha-Kopher,* a veritable encyclopaedia of law, dogmatics, philosophy and other subjects. Noteworthy among later writers in the sect were Elijah of Nicomedia (14th century), who wrote *Etz Hayyim* on philosophy and *Gan Eden* on law; Elijah Bayshayzi (*Adereth Eliyahu*) and Isaac (16th century) of Troki, Lithuania, whose *Hizzuk Emunah,* an anti-Christian polemic, made an impression in his time.

Philosophy and Theology. Owing to Arabic environment, a religious philosophy began to be developed among the Jews in the middle of the 10th century. The main problems of this philosophy were to harmonize tradition and the teachings of the Bible with the results of science, and to rationalize religion and enunciate its dogmas. The first Jewish philosopher was Saadia Gaon who, in his book *Emunoth We-Deoth* (*Doctrines and Religious Beliefs*), gave a systematic treatment of the solutions to these problems. Spain became the next center of Jewish philosophy where a series of brilliant writers arose in succession. These were Solomon Ibn Gabirol, *Mekor Hayyim,* (*Fountain of Life*); Bahya Ibn Pakuda, who wrote the *Hobboth ha-Lebaboth* (*Duties of the Heart*), primarily an ethical treatise; Moses and Abraham Ibn Ezra; and Abraham Ibn Daud (1110-80), whose treatise, *Emunah Ramah,* is a fine example of the reconciliation of religion with the Aristotelianism of the time. The greatest of the philosophers of the period was Maimonides (Moses ben Maimon) who, in his *Guide of the Perplexed* (or *More Nebukim*), gave a systematic and complete exposition of the entire Jewish philosophy. All these books were written in Arabic, but were later translated into Hebrew by Judah and Samuel Ibn Tibbon.

The outstanding philosophers from the 12th century onward were Levi ben Gerson (Gersonides, 1288-1362), whose *Wars of the Lord* was considered by many as introducing a radical tendency in Jewish philosophy; Chasdai Crescas (1340-1410), a Spanish critic of Aristotle and an original thinker whose *Or Adonai* (*Light of the Lord*) influenced Spinoza to a certain extent; and Joseph Albo (1380-1444), whose *Ikkarim* revolutionized Jewish dogmatics.

Allied to philosophy was the mystic element in Jewish literature. It dated from early times but was manifested in literature in the Gaonic period. Hebrew mysticism turned mainly upon the doctrine of

the ten *Sephiroth,* a series of emanations, and its two important books were the *Sepher Yezira (Book of Creation)*, end of 8th century, and the *Zohar (Book of Light)* of unknown origin, published first by Moses of Leon (c. 1305), who ascribed it to Simon ben Yachai, a second century Tanna. Round these two books was created a whole literature running into hundreds of works.

Miscellaneous Literature. Besides these classes of literature, numerous other books on various subjects were produced during the medieval period. There was an extensive historical literature of which the *Sepher ha-Kabbala (Book of Tradition)* by Abraham Ibn Daud, and the *Yuhasin* of Abraham Zacuta were notable examples. Likewise, a great number of books on medicine, mathematics, astronomy, physics and other sciences were translated from the Arabic and original works. The most important included the *Zurath ha-Aaretz* on astronomy and a book on geometry by Abraham bar Hiyyia (c. 1100), and *Mayon Ganim,* a collection of treatises on astronomy, mathematics and physics by Joseph Solomon Del Medigo (1591-1655). There were also numerous works of a polemic nature of which the *ha-Nizzchon,* by Yom Tob Lipman Mulhausen (c. 1400), is an outstanding example. Nor was the lighter side of literature neglected; Zabara's *Book of Delight,* a collection of fables, tales and proverbs, Berachyas's *Fox Fables,* and similar works made pleasant reading. Books on homiletics and ethics abounded. Erama's *Akedah,* Judah ben Samuel's *Book of the Pious* and Isaac Abuab's *Menorath ha-Moer (Candelabrum)* were worthy specimens of these types of literature.

MODERN HEBREW LITERATURE

The character of modern Hebrew literature differs from that of the medieval to a much greater degree than the latter differed from the literature of the ancient period. Due to a great change in Jewish life, Hebrew literature became largely secularized, the branches of rabbinics, exegesis and others were still cultivated and important contributions were made. But attention was centered upon other literary endeavors, such as poetry, fiction, essays, historical investigations and philosophic inquiries. A Hebrew renaissance took place and a movement began which centered round Moses Mendelssohn and his school. Its aim was to modernize Jewish life and bring it more into harmony with the spirit of the time. This movement, which is also known as that of the *Haskalah (Enlightenment)*, aimed to purify the Hebrew style, to return once more to the Biblical idiom, to cultivate among the Jews the taste for *belles lettres,* and to preach, through the medium of Hebrew, changes in the education of the children. The means which were supposed to bring about this renaissance were the new Hebrew commentaries, known as *Biur,* which accompanied Mendelssohn's translation of the Bible into German, and the establishment of a monthly periodical, the *ha-Measeph.* The first was supposed to promote the study of the Bible and thus aid in the cultivation of its style, the second to afford young writers an opportunity to express themselves and develop their talents.

Because of certain conditions, the movement was cut short in Germany, but progressed rapidly in the ghettoes of Eastern Europe, in Galicia and Russia. In the 1830's the second Haskalah period began and lasted for about fifty years. Like the first, it aimed to improve, beautify and modernize Jewish life. This period was succeeded by one that can be called nationalistic, during which the nationalistic movement, or Zionism, left its impress upon literature. The result of these tendencies was expressed in several forms of literature.

Poetry. Modern Hebrew poetry opened with Moses Hayyim Luzzatto (1707-47), whose allegorical dramas, *Migdal Oz (Mighty Tower)* and *La-Yeshorim Tehilah (Praise to the Righteous)* heralded a new era. Freshness and real poetry appear in his work. Moses freed Hebrew verse from the Arabic meter. He was followed in the first Haskalah period by Naphtali Weseley, a colleague of Mendelssohn and a champion of enlightenment, whose *Shirē-Tipheret,* epic poems describing the Biblical period, was a noteworthy contribution. The second Haskalah period produced a number of great poets, the most important of which were Abraham Dob Lebenson; his son Micah Joseph Lebenson, who displayed genuine poetic talent during his short life; and Judah Leon Gordon (d. 1892), considered the greatest poet of the period. He wrote epic poems, lyrics, humorous pieces and fables. In his poems, however, there reigns a polemic spirit against the opponents of enlightenment. The nationalistic period produced many outstanding poets, notable among whom were Saul Tschernichowsky, S. Schneor and Hayyim Nachman Bialik, the national poet who gave expression to the joys and sorrows of his people.

Fiction. Fiction occupies an important place in modern Hebrew literature. The first novelist of note was Abraham Mapu, who wrote two skilful novels depicting life at Jerusalem in Biblical times. He was followed by such outstanding authors as Reuben Asher Braudes, Smolenskin and Shalom Jacob Abramowitz (Mendele Mocher Sephorim). The first two were *tendenz* writers whose aim was to champion enlightenment; the last was a master of style and an excellent portrayer of ghetto life. The younger writers introduced the short story and the psychological novel. H. Brenner, G. Shofman and J. D. Berkowitz are the most distinguished among them.

Essays and Historical Works. The number of writers that contributed to the development of Jewish knowledge and opinion is very large. The most noted were Samuel David Luzzato (1800-65); Zechariah Frankel, historian of the Talmud; Solomon Judah Rappoport, author of historical essays; Nachman Krochmal, historian and philosopher whose book, *The Guide of the Perplexed in Our Own Times* (or *More Nebuka ha-Zman*), is a valuable philosophical contribution; S. Berenfeld, prolific historical writer;

and finally Asher Ginzburg (Ahad ha-Aam), a brilliant essayist whose influence was strong in the first decade of the present century.

American Jewry aided in the revival of Hebrew. Among the Hebrew writers in this country are N. Silk, Hillel Babli, Israel Efros, Ephraim Lisitzky, A. Shuer, and M. Ribalow. M. W.

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HEBREWS, EPISTLE TO THE, in the New Testament, early attributed to the Apostle Paul, is now almost universally held to have been written by another. The early Fathers never ascribed it to Paul, and not until the 7th century, following Augustine and Jerome, was he commonly called its author. Internal evidence discloses that the writer was a Jew and a Hellenist, familiar with Philo and the Jewish Scriptures, a friend of Timothy, and known to those Christians of Hebrew birth in Rome to whom the letter was addressed. Luther attributed it to Apollos; others have thought that the author was Barnabas. Its date is usually given as 65 A.D. The epistle's canonicity has never been doubted, and there can be no two views as to its value to the Church. The divine origin of the old Jewish dispensation is used by the author to emphasize the superiority of the new Christian order, and an *a fortiori* argument used: if the shadow was divine, how much more the substance fulfilling it. The vocabulary and style of the letter are said to be purer and more vigorous than in any other book in the New Testament.

HEBRIDES, THE, a chain of islands west of Scotland. There are more than 500 large and small islands in the group, but only one-fifth of them are settled. They are divided into the Outer and Inner Hebrides, separated by the Minch and Little Minch. The islands belong to Inverness-shire, Argyllshire, Ross and Cromarty, and have a population of more than 71,000. The main occupations are sheep and cattle-raising and fishing. Potatoes and turnips form the main crops. Many tourists visit the islands during the summer. Among the rocks found here are dark red sandstone, quartz, basalt and gneiss. Norwegians were the first colonists. In 1266 Scotland annexed the islands and for many years they were the subject of dispute among important Scottish families.

HEBRON, a city in Palestine, situated about 19 mi. to the south and west of Jerusalem at an elevation of 3,000 ft. The natives manufacture some glass and leather products, notably leather flasks. Hebron, often mentioned in the Old Testament, is reputed to be the site of the Biblical cave of Machpelah. Pop. 1922, 16,577; 1931, 17,532.

HECATE or **HEKATE,** in Greek mythology, goddess of the moon, and daughter of the Titan Perses and Asteria, also identified with ARTEMIS and PERSEPHONE. She had power in heaven, earth and the infernal regions. As moon goddess Hecate presided over childbirth. Hecate is usually represented with three bodies joined together or one body and three heads which face in three directions.

HECKER, ISAAC THOMAS (1819-88), American Roman Catholic priest and founder of the Paulists, was born in New York City, Dec. 18, 1819. As a young man he was a member of the Brook Farm community, but in 1844 became a Catholic, joined the Redemptorists in Belgium, and was ordained to the priesthood in 1849. The Congregation of the Missionary Priests of St. Paul the Apostle, the first religious community of men of United States origin, was founded by him in 1858, and he became its first superior. The Order was chiefly organized to conduct missions among non-Catholics. He died in New York City, Dec. 22, 1888.

HECKSCHER, AUGUST (1848-), American capitalist and philanthropist, was born at Hamburg, Germany, in August 1848. After working in an importing house at Hamburg, he came to the United States, where he engaged in the coal business. After 1884 he organized numerous industrial concerns and became a director of several banks and manufacturing companies. He established the Heckscher Foundation for Children, New York City, gave the Heckscher Park and Fine Arts Building to the town of Huntington, L.I., and donated funds for a normal school at St. Augustine, Fla.

HECLA, MOUNT, or Hekla, a volcano situated between lat. 63° 59′ N. and long. 19° 42′ W., about 20 mi. from the southwest coast of Iceland. It is a deserted, barren conical-shaped structure measuring 12 mi. in circumference at the base, with three snowy peaks, the central and loftiest of which rises 5,110 ft. above sea-level. The cone of Hecla is uneven and stabbed by gorges through which cascades descend. The constituents of the mountain are basalt and lava, covered in great part by slag-sand and loose ashes. Many eruptions have been recorded since the 12th century, the most recent having occurred in 1878.

HECTOGRAPH, a type of duplicating machine used in office work. It comprises a gelatine band mounted on rollers and an iron bed on which a portion of the unrolled band rests. The writing is done on the "master sheet" in water-soluble ink and the sheet is then placed in contact with the moistened gelatine band, which absorbs the writing. Duplicates are then obtained by pressing dry sheets of paper against the gelatine; 100 to 150 copies may be obtained in this manner.

HECTOR, in classical mythology, the greatest of the Trojan heroes, son of PRIAM, King of Troy and HECUBA, was husband of ANDROMACHE and father of Astyanax. During the siege of Troy Hector killed PATROCLUS, friend of ACHILLES, which caused the latter to redouble his attacks on the enemy. Meeting Hector at the Scaean Gate, Achilles pursued him three times round the city walls until he pierced the Trojan with his spear. Fastening the body to his chariot he dragged it through the dust, but finally gave it up to Priam for a ransom.

HECUBA, in Greek mythology, the wife of PRIAM, King of Troy, to whom she bore 19 children, among them PARIS, HECTOR, CASSANDRA and HELENUS. During the siege of Troy she saw her husband and most of her children die, and when the city was looted she fell to the lot of ULYSSES, who carried her to Greece. One legend says she was stoned to death by the Greeks because they tired of her weeping, another that she was changed into a dog and jumped into the sea.

HEDGEHOG, an insectivorous mammal of the genus *Erinaceus,* widely distributed in the Eastern Hemisphere. All species have a squat, robust body, bristling with stiff pines, and are able to roll themselves into a ball inclosing in their armor the soft nose and short limbs. The common European hedgehog is about 10 in. long, and roams about at night and in rainy weather, searching for and eating not only insects and slugs but sometimes ground-nesting birds, the farmers' chickens, and even snakes, including vipers. In cold countries it hibernates in nests made in some safe nook, where several young are born annually. Hedgehogs are kept in many European houses as destroyers of vermin. The name is sometimes wrongly given in the United States to the skunk. E. I.

HEDGING, a term employed in the commodities markets where well-developed futures exchanges exist. The hedger is a straddler between the futures or contract market and the spot market. The purpose is to avoid the risks involved in large price movements.

Smith and Company, for example, are cotton merchants buying raw cotton in the local markets and selling it to the mills at home and abroad. When Smith and Company buy, say, 1,000 bales of cotton, they simultaneously sell ten contracts (1,000 bales) on the New York Cotton Exchange. When the cotton is sold, ten future contracts are purchased in New York, canceling the earlier sale of the same number of contracts. It makes no difference to Smith and Company what the price movements have been in the interim, provided these changes have affected both their cotton and their contracts identically. What they have lost in one market they have gained in the other, and vice-versa.

In actual practice this exact correspondence between price movements in the two markets ordinarily does not occur. The differential between the two prices however, usually varies less than the price of the underlying commodity itself. The risk carried by Smith and Company is thus reduced in amount at the same time that it is fundamentally altered in nature. F. W. J.

HEDIN, SVEN ANDERS (1865-), Swedish explorer, was born at Stockholm, Feb. 19, 1865. He studied at Upsala, Berlin and Halle. His explorations have taken him to many parts of Asia, Persia, Mesopotamia, Turkestan, the Gobi desert, Mongolia, Siberia, Tibet, and other remote places. He discovered the sources of the Indus and the Brahmaputra rivers. The Berlin Geographical Society awarded him the Karl Bitter medal; he has been made a member of the Paris Academy of Sciences, and has received many other honors for his valuable scientific work. Hedin is the author of *Through Asia, My Life as an Explorer, Adventures in Tibet* and other works on countries he has visited.

HEDONISM, an ethical theory holding that pleasure is the good. Less frequently it has been applied to a psychological doctrine defined below. It may take a number of different forms; but in any case conduct is to be judged by pleasure as the test of good in life. Hedonistic theories may be classified as follows: (1) Quantitative vs. qualitative hedonism; (2) Egoistic vs. universal hedonism; (3) Psychological vs. ethical hedonism.

The distinction between quantitative and qualitative hedonism lies in the measuring of pleasure by its degree in the one, by its kind in the other. Quantitative hedonism holds that man ought to seek the greatest pleasures; qualitative hedonism that some pleasures are better than others even though quantitatively inferior. Egoistic hedonism would have the individual seek the pleasures that are most gratifying to himself; universalistic hedonism would have him seek the happiness of the greatest number of people affected by his conduct. Psychological hedonism takes the position that the will is necessarily determined by pleasure and that pleasure is the object of desire; ethical hedonism contends that even if the good of conduct is not necessarily measured by pleasure it ought to be so measured. In the last instance the distinction is made between pleasure as the motivating force of desire and pleasure as the standard by which conduct ought to be judged.

HEDRICK, ULYSSES PRENTISS (1870-), American pomologist, born in Independence, Ia., Jan. 15, 1870. He graduated from Michigan State College in 1893 and took his M.S. degree in 1895. After graduation, he became an assistant horticulturist at Michigan State College, 1895-97, and occupied the same position at Utah College, 1897-99. He returned to Michigan State as horticulturist, 1899-1905, and he has been stationed in the same capacity at the N.Y. Agricultural Experiment Station, in Geneva, since 1905. His chief interests have been pomology and tree and small fruit breeding. Among his most important works are, *Grapes of New York,* 1908; *Plums of New York,* 1910; *Cherries of New York,* 1915; *Manual of American Grape Growing,* 1919; *Cyclopedia of Hardy Fruits,* 1921; *Systematic Pomology,* 1925; and the *Vegetation of New York,* 1929.

HEEP, URIAH. *See* URIAH HEEP.

HEERLEN, a city in the Dutch province of Limburg near the German frontier. It is a rapidly growing center of coal mining in the Netherlands. Pop. 1930, 46,505.

HEGEL, GEORG WILHELM FRIEDRICH (1770-1831), German philosopher, was born at Stuttgart, Aug. 27, 1770. Like JOHANN FICHTE, he studied theology and served as a private tutor before entering on his academic career. In 1801 he went to Jena

and in 1816 became professor of philosophy at Heidelberg. From 1808-16 he was in charge of the Nurenberg Gymnasium. Hegel occupied the chair in philosophy at the University of Berlin from 1818 until his death 13 years later. His *Phenomenology of Spirit* was published in 1807 and his *Principles of Logic* between 1812 and 1816. The period at Berlin was given mostly to lecture work. Several books were compiled from notes after his death, which occurred Nov. 14, 1831 at Berlin.

In Hegel the philosophy of absolute idealism reached its full fruition. Applying his dialectical method, subjective and objective mind come together in the Absolute Mind. The universe is essentially rational and history is but an expression of the Absolute Mind working itself out concretely. Hegel gave expression to a very popular viewpoint, particularly from the standpoint of Protestant religious faith. This doubtless accounts for the influence that his philosophy had, but this Hegelmania, by its own dialectic, produced a Hegelphobia.

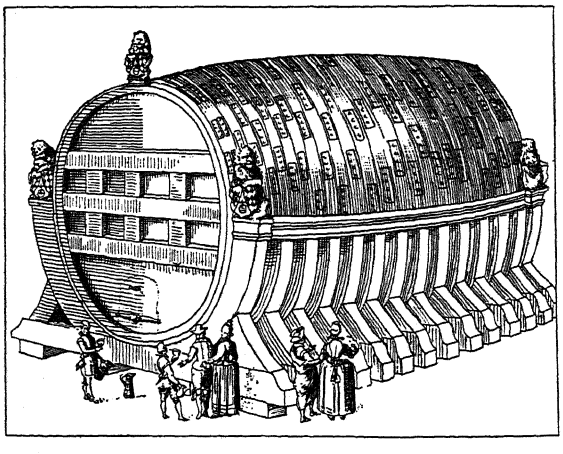
HEGEMONY, the political ascendency and leadership of a particular state in a community of independent states. Hegemony in this sense was sought and claimed at one time or another in ancient Greece by such states as Athens, Sparta and Thebes. Today a state evincing a disposition to extend its political control over other states and place them in a subordinate position is said to be seeking a position of hegemony.

HEGIRA, OR FLIGHT OF MOHAMMED. The preaching of Mohammed at Mecca roused the opposition of the Koreish, defenders of idol worship in the Kaaba. Beginning with ridicule, the Koreish soon turned to persecution. The death of Khadija, Mohammed's wife, removed a powerful influence. Mohammed and his followers were forced to flee for their lives to Yathrib, renamed Medina, where he already had a number of converts. This hegira, or flight, took place in the year 622, from which date the Moslems reckon the beginning of their era.

HEIBERG, JOHAN LUDVIG (1791-1860), Danish dramatist and poet, was born at Copenhagen, Dec. 14, 1791. He was the son of Peter Andreas Heiberg, also a dramatist, who was exiled from Denmark because of his bitterly satirical attacks upon the king and the government. The younger Heiberg was educated in Denmark. He wrote a number of witty vaudeville sketches, including *King Solomon and Jorgen the Hatter, The April Fools, The Critic and the Beast* and *The Inseparable Ones.* The best known of his longer plays is perhaps *Elf Hill.* In addition to his plays he wrote many lyric poems and contributed critical articles to *Den Flyvende Post* and *Intelligensblade,* both of which journals he edited at different times. He died at Copenhagen, Aug. 25, 1860.

HEIDELBERG, a German city in the province of Baden, located on the Neckar River about 21 mi. southeast of Worms. It was the capital of the Rhenish Palatinate till 1720. It rivals all other places in Germany in tradition and attractiveness. The university was founded in 1386 and is the oldest university within the present confines of Germany. Above the city rise the magnificent ruins of the castle. The old city is crowded between the mountain and the Neckar. Near its center is the university library with its rare manuscripts, the university building, the Archeological Institute, and the Baroque Rhenish-Palatinate Museum of 1712 with noteworthy collections. On the market place is the Holy Ghost Church, 15th century, the inn "zum Ritter," of 1592—almost the only house which escaped the devastation of 1693—and the rathaus of 1703. The castle was begun under Count Palatine Ludwig I, in 1583-1610, and completed by his successors down to Frederick V. The French demolished it in 1689 and 1693. It is still a ruin, but as to grandeur and beauty it has not a peer in Germany. Pop. 1925, 78,196.

HEIDELBERG, UNIVERSITY OF, at Heidelberg, Germany, the second oldest German university. It was founded in 1386 by Rupert I, Elector Palatine, and was modeled by its first rector, Marsilius von Inghen, after the UNIVERSITY OF PARIS. In the 16th century, guided by Melanchthon, the humanist, the university became humanistic instead of scholastic, and Protestant instead of Catholic. In 1622, when Tilly captured Heidelberg, the university was suspended and its renowned collection of manuscripts was sent to Rome, where it was known as the Biblioteca Palatina. Reopened in 1652, the university was again suspended in 1693; and it led a troubled existence from 1700-1803, when it was reconstituted by Charles Frederick, Grand Duke of Bavaria. The present university has faculties of theology, law, medicine and philosophy. The students number about 1,500. In 1930 the rector was Prof. Dr. Emil Gotschlich.



THE CREAT TUN OF HEIDELBERG

In the cellar of the Friedrichs-Bau, part of Heidelberg Castle, is this enormous wine vat capable of holding 49,000 gals. It was constructed in 1751 by the Elector Charles Theodore

HEIDELBERG CASTLE, a famous Medieval edifice of Heidelberg, Germany, first constructed in the 12th century, but through the ravages of time, of battles, and of lightning—in 1764—now an ivy-covered

ruin. Conrad of Hohenstaufen was possibly the founder, but Count Palatine Lewis I is a more probable surmise. The finest parts were built in the 16th and early 17th centuries and are specimens of decorative Renaissance architecture. The castle is composed of many large buildings irregularly constructed; it is surmounted by the Great Watch Tower. There are vast halls, deep dungeons and many cellars, in one of which is the giant Heidelberg tun, a wine cask having a capacity of 49,000 gals. A park surrounds the castle which is further enclosed by a moat crossed by a bridge.

HEIDELBERG COLLEGE, a coeducational institution at Tiffin, O., founded and supported by the Reformed Church in the United States, was opened in 1850. The productive funds in 1931 were $966,677. There were 25,000 volumes in the library. The student enrollment in 1931-32 was 430; the faculty of 37 was headed by Pres. Charles E. Miller.

HEIDENSTAM, CARL GUSTAF VERNER VON (1859-), Swedish poet and novelist, was born at Olshammar, July 6, 1859. Delicate health made it advisable for him to spend most of his youth in journeys to Rome and the Orient. Later he studied art in Paris. His first book was a collection of poems, *Pilgrimage and Wander-Years,* and his first novel was *Endymion.* Both these works bear the impress of his travel experiences, but most of his later works deal with life in medieval Sweden. To this class belong *The Charles Men, The Forest Murmurs, Saint Birgitta's Pilgrimage, The Folkung Tree* and *The Bjalbo Heritage.* These are all novels or collections of short tales. In addition, Heidenstam has produced several volumes of poems. He was awarded the Nobel Prize for Literature in 1916.

HEIFETZ, JASCHA (1901-), Russion violinist, was born at Vilna, Feb. 2, 1901. As a child he startled his auditors, playing Mendelssohn's concerto at the age of six. He entered the St. Petersburg Conservatory, where he studied with LEOPOLD AUER. At the age of 13 he made his début in Germany, and at the age of 17 he toured the United States, where his brilliance created a furor. Since then he has performed in many countries. He has been ranked among the supreme violin virtuosi of his time.

HEIGHTFINDER. *See* RANGEFINDER.

HEIJO-FU. *See* PYONG YANG.

HEILBRONN, a manufacturing and commercial city on the Neckar River in northern Württemberg, Germany, about 17 mi. north of Ludwigsburg. It was formerly a free imperial city. On the market place is a statue of Robert Meyer, scientist, also the rathaus, 1579-82. An ancient house nearby is said to be that of Kätchen von Heilbronn; other notable buildings are St. Kilian's Church of the 13th century and the "German House," originally an imperial residence and later the property of the Teutonic Order. The industries of the city include the manufacture of metal wares, machinery and automobiles. Pop. 1925, 45,520.

HEINE, HEINRICH (1797-1856), German lyric poet, essayist, and journalist, was born at Düsseldorf, Dec. 12, 1797. His father was a wealthy Jewish merchant and his mother the daughter of a distinguished physician. He was educated in a Jesuit monastery and in the German universities of Bonn and of Göttingen. An attempt at a business career proved an utter failure, and he decided to enter on the profession of law. He was therefore forced to embrace Christianity in 1825, an act which was a formal requisite for admission to the profession. This enforced apostasy left an indelible impression on Heine's sensitive nature and explains to a certain extent his later cynicism and caustic wit. He had little to do with law, however, and chose instead to engage in free-lance journalistic and other literary work in Munich and Berlin during the years 1827-30. It was in this period that he produced his most famous works: *Buch der Lieder,* or *Book of Songs,* and *Reisebilder,* or *Sketches of Travel.* In 1831 Heine settled permanently in Paris. Here for the last 10 years of his life he was chained to his "mattress bed," as he called it, the helpless victim of a spinal affliction, half blind and in dire poverty. The miseries of the final years were somewhat relieved by a small pension granted by the French Government in recognition of his revolutionary services. The lyric quality of Heine's verse is unexcelled and yields comparison only to the famous lyrics of GOETHE. Composers have vied with one another in setting his charming songs to music. The *Reisebilder* are brilliant sketches of mixed prose and verse containing perhaps the wittiest and gayest as well as the bitterest passages in all literature. Heine died in Paris, Feb. 17, 1856.

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HEINEMANN, WILLIAM (1863-1920), English publisher, was born at Surbiton, May 18, 1863. He founded the William Heinemann publishing house, London, in 1890. Intimate with many noted European men of letters, he first introduced to English-speaking readers Maeterlinck, Björnson, Ibsen, and was the only authorized publisher of Tolstoy. Among his financially successful publications were Hall Caine's novels. He wrote several plays, including *Summer Moths,* 1898, and *War,* 1901. Heinemann died in London, Oct. 5th, 1920.

HEINICKE, SAMUEL (1727-90), German educator, was born at Nautschütz, Germany, Apr. 10, 1727. He studied at Jena and went to Hamburg, where in 1772 he taught a deaf and dumb boy to talk by using methods partly his own and partly those given in Amman's treatise *Surdus Loquens.* Six years later he established in Leipzig the first school in Germany which provided systematic education for deaf-mutes. Heinicke died at Leipzig, Apr. 30, 1790.

HEINS, GEORGE LEWIS (1860-1907), American architect, was born at Philadelphia, May 24, 1860. He obtained academic education at the University of Pennsylvania, then he studied architecture at the Massachusetts Institute of Technology, and in 1883 opened offices in Minneapolis, moving to New

York in 1886. His firm made the first designs for the Cathedral of St. John the Divine, planned the buildings for the New York Zoological Park, and were architects for numerous other important structures. In 1898 Mr. Heins was appointed first State architect of New York, a position which he held until his death, at Lake Mohegan, N.Y., on Sept. 25, 1907.

HEIR. Where an owner of property dies intestate, the question who is to succeed to the property is determined by blood relationship, which is of two types: Lineal relationship exists where one person is descended in direct line from the other, and collateral relationship where relatives are descended from the same person but not in a direct line.

Collateral kinship is reckoned as follows: Suppose nephew and cousin are competing for deceased's property; the common ancestor of the nephew and deceased is deceased's father and the nephew's grandfather. It is one degree from deceased to the common ancestor and two degrees from him down to the nephew. The nephew is related in the third degree. But the common ancestor of the cousin and deceased is the grandfather of each, from whom each is removed two degrees. Thus the cousin is related to deceased in the fourth degree.

Inheritance is regulated wholly by statute. (*See also* FEE.) A. E. E.

HEJAZ, a kingdom of Arabia, stretching along the Red Sea for about 800 mi. and extending inland from 100 to 200 mi. bounded on the north by Palestine and on the south by the lands of Yemen. The total area of Hejaz is about 150,000 sq. mi. and its population is estimated at from 800,000 to 1,000,000. Most of the inhabitants are Beduin. The largest city is MECCA, with a population of 35,000. Jedda or Jidda, the port of Mecca, about 50 mi. distant has a population of 25,000. The chief products of Hejaz are: dates produced abundantly in Medina; honey and fruits which are the products of the valleys and the hills; hides and wool, the staple products of the desert. There are practically no exports and the country depends for its existence upon the large number of Moslem devotees who make annual pilgrimages to Mecca and MEDINA. Before the World War Hejaz formed a vilayet of the Ottoman Empire and Mecca was the residence of the valie. During the World War the Beduins joined the general Arab movement against the Turks. The goal of a united Arab kingdom, however, was not achieved and was a disappointment alike to the Arabs. Hejaz is now under the rule of Ibn Saud who is also ruler of Nejd and who has his capital at Riyadh in the Nejd. Great Britain recognized the complete independence of King Ibn Saud by a treaty signed in Jedda in May 1920. *See also* NEJD; ARABIA.

HEKATE. *See* HECATE.

HEKLA. *See* HECLA.

HELDER, a seaport city in the Dutch province of North Holland. It is located on the North Holland Canal, the terminus from Amsterdam. Formerly a fishing village of the 18th century, the city is now a flourishing commercial port; it is also a naval and military depot. In 1811 Napoleon fortified Helder and the Netherlands later increased these defenses until the city became one of the strongest fortifications in the country. Pop. 1930, 29,720.

HELENA, ST. (?-c. 328), the mother of Constantine the Great, was born Flavia Julia, about the middle of the 3rd century. Although legend says that she was a Caledonian princess, she was probably the daughter of an innkeeper at Drepanum, later known as Helenopolis. She became the consort of Constantius Chlorus who in 292, when he became Caesar, divorced her to marry Theodora. When her son Constantine became Caesar, she received from him the title of Augusta, and under his influence accepted Christianity. About 325 she went as a pilgrim to Jerusalem where she built two churches and according to tradition found the True Cross. She died some three years later.

HELENA, a city and the county seat of Phillips Co., in eastern Arkansas, situated on the Mississippi River. Bus lines and three railroads serve the city; and freight-carrying barges operate on the Mississippi River. The chief industry is shipping cotton and lumber, and their products. Well-constructed levees protect the city from any rising of the river. Helena was founded in 1821. Pop. 1920, 9,112; 1930, 8,316.

HELENA, the capital of Montana, and the county seat of Lewis and Clark Co., situated in the west central part of the state, about 60 mi. northeast of Butte. The transportation facilities include the Great Northern and the Northern Pacific railroads. Protected on all sides by the Rocky Mountains, the city is beautifully located with Mt. Helena for a background and possesses many fine homes. The surrounding country raises cattle and yields crops of wheat, hay, potatoes, rye and sugar beets. In 1929 the manufactures, which are varied, amounted to about $1,000,000; the retail trade amounted to $9,497,268.

In 1864, when gold was discovered in Last Chance Gulch, the town was founded by placer miners. After Montana became a territory in 1864, Helena was made the capital; and in 1888 it was incorporated. Pop. 1920, 12,037; 1930, 11,803.

HELEN OF TROY, in Greek mythology, the daughter of Zeus and Leda, and the wife of Menelaus, King of Sparta. Her surpassing beauty caused Paris, son of Priam, King of Troy, to steal her in Menelaus's absence, and this theft aroused the Greeks to their 10-year siege of Troy. After the fall of Troy, Menelaus took Helen back to Sparta, where she lived till her death. Her grave was supposed to be at Therapnae in Laconia. Helen was worshipped as a goddess in various parts of the Greek world. Her beauty has been a theme for poets since the time of Homer. *See also* AENEID; ILIAD; ODYSSEY.

HELENUS, in Greek mythology, a soothsayer, son of PRIAM, King of Troy, and of HECUBA, and twin of CASSANDRA. He foretold the fall of Troy and was the one who suggested that the hollow wooden horse filled with Greeks be taken into the city.

HELFFERICH, KARL (1872-1924), German financier, was born at Neustadt-on-the-Havel July 22, 1872. He served as secretary of state for the Imperial treasury in 1915 and his policy of borrowing to defray the cost of the war was much criticized. In June 1916 he became minister of the interior and after the armistice demobilization, both economic and industrial, was entrusted to him. Helfferich opposed Erzberger's policy of fulfilment of treaty obligations. He was killed in a railway accident, Apr. 23, 1924.

HELIACAL RISING, in astronomy, a term used to indicate the first time each year a star becomes visible in the morning sky before sunrise.

HELIAMPHORA, a genus of four species of pitcher plants of the family *Sarraceniaceæ,* natives of the Pacaraima Mountains of southern Venezuela and adjacent British Guiana and distinguished from the North American pitcher plants by the absence of petals and the truncate style. H. A. G.

HELICAL GEARS. *See* GEARS AND GEARING.

HELICON, a mountain range in Boeotia, southeastern Greece, extending from the Gulf of Corinth to Lake Copais. The highest peak is Palaeovouno, 5,738 ft. Among these mountains are many places famous in legend and history, such as the fountains, Aganippe and Hippocrene; the grove and temple dedicated to the ancient cult of the MUSES, and Ascra, the home of the poet Hesiod. Myth has it that no poisonous plant or evil creature lived here.

HELICON HALL, an institution organized in 1908 in Englewood, N.J., by UPTON SINCLAIR and several other professional men and women with a view to better community living. In the Hall each individual or family had separate apartments, but they cooperated in the running of a common kitchen and dining room, and organized a nursery for the care of the 14 children. After six months of operation, a fire broke out from a mysterious cause, and the Hall burned to the ground. The residents lost practically all of their possessions and the experiment came to an end. H. W. L.

HELICOPTER, a heavier-than-air craft which derives its lifting force from the downward thrust of one or more horizontal rotating, power-driven AIR PROPELLERS. In theory, this permits the craft to take-off and land vertically, to hover and to travel horizontally when desired. Its chief attraction to inventors is its promise of obviating the large landing field required by all other types of AIRPLANES. However design theory has not yet been evolved which assures stability, control and maneuverability in these machines. Each design is therefore still a pioneering project. Elementary flights have been accomplished with radically differing designs, but the most successful results have been secured by machines sustained by large-diameter, slow turning, wing-type, lifting propellers. Two or three somewhat related designs of this character, developed recently, have shown promise. *See also* AUTOGIRO. M. B. B.

HELIGOLAND or **HELGOLAND,** an island in the North Sea and a part of Schleswig-Holstein, located about 45 miles from the mouths of the Elbe and Weser Rivers. The area of the island had been steadily reduced by erosion until in 1910 a high sea wall was constructed to protect its shores. Ceded to Great Britain by Denmark in 1814, Heligoland remained a British possession until its cession to Germany in 1890. It was then strongly fortified as a strategic naval defensive position becoming known as the "Gibraltar of the North Sea." Under a provision of the Treaty of Versailles these fortifications were dismantled. During the World War, British ships won a decisive victory here over the German naval forces in the Battle of Heligoland.

HELIOCENTRIC SYSTEM, or COPERNICAN SYSTEM, that conception of the solar system in which the sun is supposed to be immobile in the center.

HELIODOR, a variety of the semi-precious BERYL. Other varieties are AQUAMARINE, MORGANITE, colorless goshenite and the precious EMERALD. Heliodor is a yellow beryl mined in Southwest Africa, usually occurring in granite pegmatites. *See also* GEM STONES; PRECIOUS STONES; PEGMATITE.

HELIODORUS (fl. c. 290), Greek romance writer, was born at Emesa, in Syria. He flourished, most likely, at the end of the 3rd century, although he is sometimes erroneously identified with another Heliodorus, Bishop of Trica in Thessaly, who flourished about 390. He was the author of a romance entitled *Aethiopia,* in 10 books. This work relates the story of Charicles, daughter of a king of Aethiopia, who becomes a priestess at Delphi, and Theagenes, a noble Thessalian, whom she marries after many trying adventures. The book is remarkable for its originality and vividness of description, and the simplicity and elegance of its style. It is one of the finest surviving specimens of its kind in ancient GREEK LITERATURE, and has served as a model for many later romances.

HELIOGRAPH, an instrument for transmitting messages in code by means of the sun's rays. In its simplest form, the heliograph is a mirror which may be turned so as to reflect the sun's rays to any desired receiving station, the movement of a shutter producing flashes to represent the dots and dashes of the MORSE CODE or other codes. Such a system is useful as a simple and quick means of communication between two points within sight of one another, e.g., in forestry look-out service.

When employed in SURVEYING, the heliograph is used merely as a mark to sight upon and is called a heliotrope. The pointing device may consist of two rings having their centers marked by threads or wires. In Steinheil's heliotrope the pointing is done by means of an optical device.

HELIOMETER, an instrument used in astronomy to measure very small angles, and deriving its name from the fact that it was first used in connection with the SUN. The essential feature is an object glass cut in two parts, independently movable.

HELIOPOLIS, *see* BAALBEK.

HELIOS, in Greek mythology, the same as the Roman Sol, god of the sun. He was the offspring of

HYPERION and Thea, and the brother of Eos and SELENE. Helios was said to have a palace in the east, whence each morning he was drawn across the sky in a fiery chariot by four white horses to another palace in the west.

HELIOSTAT, an instrument for providing a stationary beam of light by REFLECTION from a mirror moving at the proper speed to neutralize the earth's rotation. The two-mirror form throws the light in a direction parallel to the earth's axis, the beam then being reflected in any desired direction by a second fixed mirror. A simpler form sends the light in any given direction at the first reflection. The former type is more certain in operation. The heliostat cannot be used in photographing an extensive part of the heavens, as the image rotates about a central fixed point. This fault is eliminated in the COELOSTAT.

HELIOTHERAPY, treatment of diseases by means of exposure to sun's rays. Its beginnings are traceable to early ages when the sun was worshipped as the source of all life and most of the energy which man utilizes. As mankind became more intelligent, the ideas and attitudes behind the use of sunlight clarified through experience and observation. Hippocrates, who may be considered the father of medicine, advocated sunbaths for the treatment of wounds. Sunlight grew in favor as a tonic and therapeutic agency so that, at the height of power and prosperity of the Roman Empire, solariums with unglazed openings were common accessories to every villa.

Apparently, heliotheraphy fell into disrepute after the fall of the Roman Empire. Perhaps this was due to exaggerated claims and practices which are inevitable when knowledge is incomplete. With the exception of spasmodic revivals of little importance, heliotherapy was dormant until near the close of the eighteenth century, when Faure advocated the treatment of ulcers of the skin by means of sunlight. Chauvin, in 1815, prescribed sunlight as a tonic in diseases with which feebleness, exhaustion and apathy were associated.

In 1666, Newton showed that the light from the sun consisted of energy of various wave-lengths, but it was not until the opening of the nineteenth century that the invisible ultra-violet and infra-red were discovered. This new knowledge pertaining to sunlight naturally led to advancement and understanding of its use as a therapeutic agent. Toward the close of last century, Niels Finsen and A. Rollier became conspicuous in heliotheraphy. They are largely responsible for the re-entry of sunlight and the introduction of radiant energy from artificial sources into the good graces of the medical profession and general use by the public.

In this country Dr. J. H. Kellogg was perhaps the first (1876) to employ the sunbath systematically under medical supervision. There are now a number of outstanding pioneering contributors to the development of heliotherapy. However, with the advent of effective artificial sources, more convenient, dependable and powerful than sunlight, the professional trend is away from heliotherapy towards actinotherapy or, more broadly, radiation therapy with artificial sources.

Although plants predominantly utilize the visible energy in sunlight, most of the important known biological benefits to animals are attributed to the ultra-violet radiation of wave-lengths (λ 2900 to λ 3200) which are not appreciably transmitted by ordinary glass. Sunlight is acknowledged as a tonic and health-maintaining agency, but with few exceptions there is no unanimity of medical opinion in regard to the cure of diseases. Therefore, it is difficult to make a brief and safe statement.

The prevention and cure of rickets have been extensively studied and sunlight or its equivalent is known to be essential for the deposit of proper quantities of calcium in the bones of growing children. The greater prevalence of rickets at the end of winter led to the discovery of the importance of the ultra-violet radiation in sunlight. Among the other diseases and disorders which seem to have yielded to heliotherapy are secondary anemia, various kinds of tuberculosis and certain skin infections. Applied carefully, sunlight doubtless has at least an indirect beneficial effect upon a great many ills.

Sunlight has been a powerful environmental factor throughout the eons of evolution of life and it seems likely that it has become intricately interwoven in life-processes. During recent centuries civilized human beings are living indoor lives which, combined with clothing, rob the body of sunlight. Knowledge is only fragmentary, but it is a logical conclusion that more of human physiological disorders than are known to-day are due in part to sunlight starvation. This screening of the human skin from natural sunlight in itself provides opportunity for the beneficial application of heliotherapy.

It is known that the visible and short-wave infra-red radiations in sunlight penetrate bodily tissue to a considerable depth. Through the heating effect, normal processes are stimulated with a resulting benefit in many cases. On the other hand, in certain diseases or for persons in a weakened condition, undue heating may be harmful.

The beneficial ultra-violet radiation does not penetrate deeply. In fact, it is readily absorbed by most materials, including the atmosphere. As a consequence, when the sun is at low altitudes, early and late in the day and throughout the winter months (in the temperate zone), the intensity of beneficial ultra-violet radiation is much less than during midday in midsummer. Complete knowledge pertaining to the biological effectiveness of ultra-violet radiation is not available at present, so exact determinations of the effectiveness of sunlight for different seasons and atmospheric conditions cannot be made. However, careful computations and measurements indicate that on clear days at the spring or fall equinox the average maximum intensity of ultra-violet radiation of most importance is only one-third that in midsummer. During winter months it falls to a very low relative value.

Clouds, smoke and dust reduce the therapeutic value of sunlight considerably.

Excepting perhaps in rare cases and for long exposures, skylight is not considered to provide sufficient intensities of ultra-violet radiation for therapeutic purposes. Therefore, to obtain benefit in most cases it is necessary to be exposed to direct sunlight. For indoor treatment the openings for admitting the sunlight must be either unglazed or glazed with a special glass or other medium transparent to the energy of certain wave-lengths. This is readily accomplished in solariums for treatment purposes. However, during recent years there has been much agitation toward a more general application of these special media to windows of homes, offices and factories in order that healthy persons may receive the benefit of sunlight. Such general application would achieve little, because indoors relatively few persons have the opportunity or the desire to remain in the direct sunlight. The relatively small quantities of skylight which find their way indoors are at present considered to be insufficient for producing a beneficial effect. *See also* LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE; RADIUM AND RADIUM THERAPY; ROENTGENOLOGY AND ROENTGENOTHERAPY. M. L.

HELIOTROPE (*Heliotropum arborescens*), a small shrub of the borage family, native to Peru and widely grown as a garden ornamental. It grows about 2 ft. high with narrow, very veiny and wrinkled leaves and small, lilac-blue, vanilla-scented flowers borne in branching, somewhat coiled clusters. There are numerous variant forms in cultivation, some of which have white flowers.

HELIOTROPE, an instrument used in geodetic surveying. *See* HELIOGRAPH.

HELIOTYPE, a picture printed directly from the inked surface of a gelatine plate. The process is made possible by the fact that light hardens bichromated gelatine, rendering it non-absorbent. A plate of sensitized gelatine is exposed to light under a photographic negative, soaked, superficially dried, and inked with lithographic ink. Wherever the plate was protected by dark areas in the negative, i.e., the high lights, the gelatine, having freely absorbed water, refuses the fatty ink. Harder parts take ink in proportion to the amount of water they hold. The resultant print is a facsimile of the tone gradations of the original.

HELIUM, a chemical element belonging to the group of the rare gases. It is colorless, odorless, lighter than any gas except hydrogen (chemical symbol He, at. wt. 4.). It is the most difficult gas to liquefy; it boils at —268.5° C. and freezes at about —270° C. By rapid evaporation of liquid helium under reduced pressure, extremely low temperatures may be reached, very near the absolute zero (—273° C.), affording important possibilities for the study of the superconductivity of metals.

The discovery of its existence in nature dates from 1868 when Janssen observed in the spectrum of the chromosphere during a total eclipse of the sun, a yellow ray of light which could not be matched on earth. This was consequently ascribed by Lockyer to the presence of a new element which he called helium, derived from the Greek word *helios,* the sun. In 1894, Ramsay obtained it on earth by heating the mineral cleveite, while later it was proved to be a constituent of the atmosphere to the extent of one part in about 200,000. Recently it has been found to occur in some natural gases.

Formerly helium was generally obtained either from certain minerals or from the atmosphere. At present the chief supply of it lies in natural gas occurring in some parts of the United States, which, in some localities, may contain up to 1% of helium. The plant at Fort Worth, Texas, which can handle about 45,000 cubic feet of gas per hour, first removes some of the constituent gases by chemical means, and the others by cooling and liquefaction, then purifies the helium by passing it over activated charcoal (*see* CARBON, ACTIVATED). Of all the rare or inert gases, helium seems to be the only one that exhibits some chemical activity. By exposing it to silent electrical discharges, it is possible to make it combine with mercury and some other elements.

Although twice as heavy as hydrogen, the difference in density between helium and air as compared to that between hydrogen and air stands in the ratio of about 13 to 14, thus giving it almost the same buoyant power. This, coupled with the fact that it is entirely uninflammable renders helium an ideal material for filling AIRSHIPS. In the laboratory and in researches into atomic theory helium is of great importance, owing to the fact that it is the next simplest atom to hydrogen, as well as the principal disintegration "waste-product" of uranium, radium, radon, and many similar substances, all of which emit charged atoms of helium in the form of alpha rays. W. J. L.

HELL-DIVER, one of the various names applied to the pied-billed GREBE, a diving bird of remarkable quickness and alertness, swimming long distances with ease with only its bill above the water.

HELLE, in Greek mythology, daughter of Athamas, King of Orchomenus, in Boeotia, and of the goddess Nephele. Phryxus was Helle's brother. Athamas forsook Nephele and married Ino who plotted the destruction of Nephele's children. They escaped on the ram with the golden fleece, given them by their mother. In flight, Helle fell into the waters later named for her the Hellespont. Phryxus reached Colchis with the Golden Fleece which was the object of the Argonautic Expedition.

HELLEBORE, the common name for a genus (*Helleborus*) of perennial herbs of the crowfoot family. There are about 15 species, natives of Europe and western Asia. The black hellebore (*H. niger*), called also Christmas-rose, which in mild regions blooms in mid-winter, is a low plant with thick, evergreen, much-divided leaves and large white or purplish flowers, 2 in. across. Many varieties are in cultivation. The green hellebore (*H. viridis*) with large, drooping, yellowish-green flowers, native to limy soils in Europe, is sparingly naturalized in the

eastern United States. Various species of *Veratrum*, a genus of poisonous plants of the lily family, are called hellebore. *See* VERATRUM.

HELLEBORINE (*Serapias Helleborine*), a perennial plant of the orchid family called also bastard hellebore. It is native to many parts of Europe and has become naturalized in the eastern states and Canada, especially western New York where it occurs in weedlike profusion. The plant grows 1 to 2 ft. high with a stoutish stem bearing several oblong, pointed leaves and a long leafy-bracted cluster of greenish-yellow or sometimes purple flowers. This plant, first noticed in America about 1880, has the appearance of a native orchid.

HELLESPONT, the ancient name of the DARDANELLES, a narrow strip of water between Europe and Asia, joining the Aegean Sea and the Sea of Marmora. It is over 42 mi. long and from 1 to 5 mi. wide and has a strong current. Turkey controls the waters. The European coast is bare and steep, the Asiatic thickly wooded and has had rich gold mines. The Hellespont is celebrated for the crossings by Xerxes in 480 B.C. and by Alexander in 344 B.C. Legend tells of Leander who swam the Hellespont every night to see Hero.

HELL GATE, a narrow passage in the East River, New York City, about 7 mi. north of the Battery, between Manhattan Island and Long Island. It was formerly extremely difficult and dangerous to navigate, due to rocks and reefs and the conflicting tides of New York Bay and Long Island Sound. These obstacles were finally removed by dredging and explosives. In 1917 the New Haven railroad completed a steel arch railway bridge across the East River at Hell Gate. It is one of the largest arch bridges in the world, with a span of 1,017 ft. and was constructed at a cost of $15,000,000.

HELMET, a headpiece worn for protection in battle. It constituted a part of ancient and medieval armor. In modern times, until the World War, its use has been more or less confined to mounted troops, the Infantry having discarded it on account of weight. In the trench or siege warfare of the World War it came into general use by infantry. France adopted the first helmet during the World War, a thin steel cap worn inside the regular cloth cap with which the infantry was equipped. This was followed later by the casque-shaped steel helmet still in use. German and British helmets made their appearance in 1915. The American helmet was copied from the British and manufactured in the United States according to a British formula of twenty-gauge (.036 inch) manganese steel alloy (12%). It is capable of resisting a cupro-nickel jacketed pistol bullet of 230 grains travelling at the rate of 650 foot seconds. E. D. P.

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HELMET BIRD (*Ærocharis prevosti*), a remarkable bird found in Madagascar, somewhat allied to the shrikes. It is about a foot in length, with chestnut and black more or less glossy plumage and a large, compressed bill about 2 in. long and largely encasing the front of the head. The helmet bird moves in small parties frequenting dense forests and feeding entirely upon insects.

HELMET SHELL, the popular name for members of a genus (*Cassis*) of sea snails, belonging to the family *Cassidae*. There are about 50 species of helmet shells. Most of them live in Oriental waters, but some are found in the Mediterranean, and others around the West Indies. They are big, active and carnivorous.

The shells have ornamental ridges which often serve to heighten their likeness to ancient helmets, whence their name. These shells are formed in layers of different colors, frequently very beautiful. As they are large, thick and heavy, they are often used for making cameos. The shells particularly sought for this purpose are those of the black helmet shell (*Cassis madagascarensis*) of the West Indies, *Cassis glauca, Cassis rufa, Cassis cornuta* and the queen conch (*Cassis tuberosa*). *See also* CONCH.

HELMHOLTZ, HERMAN LUDWIG FERDINAND VON (1821-1894), German scientist, born in Potsdam, near Berlin, August 31, 1821, was educated as a surgeon for the Prussian army. In 1847, he published an essay which established his reputation. In 1849, he was appointed professor of physiology and pathology at Königsberg; he was professor of anatomy and physiology at Bonn (1855-1858); professor of physiology at Heidelberg (1858-1871), and professor of physics at Berlin (1871-1894). His contributions to physiologic optics are of inestimable value, as was also his work on physiologic acoustics. He invented the ophthalmoscope in 1851 and completed the demonstration of the mechanism of accommodation in the eye. In the latter part of his life his investigations were extended to the sciences of mechanics, hydraulics and meteorology. He was a pioneer in the study of electrical oscillations and it was while studying a problem suggested by him that HERTZ discovered electromagnetic waves.

HELMOND, a city in the Dutch province of North Brabant, located on the Aa and on the Venlo-Breda Railroad. Helmond has an important linen and calico industry, machine factories, breweries, an iron foundry and a wire factory, and engages in a small amount of trade. Pop. 1930, 25,226.

HELMONT, JOHANN BAPTIST VAN (1577-1644), Flemish physician and chemist, was born at Brussels in 1577. After studying at Louvain and travelling for some years, he established, in 1609, a private laboratory near Brussels. He advanced the knowledge of fermentation and made the first critical analysis of the physical nature of gases, inventing that term, and distinguishing carbon dioxide and other gases theretofore confused. He attempted a new systematization of medical knowledge, the iatrochemical relations, and wrote works upon medicine. He died at Vilvorde, Dec. 30, 1644.

HÉLOÏSE (c. 1101-1164), the lover and wife of the philosopher ABÉLARD, was born at Paris about 1100.

She married Abélard against the wish of her uncle, who later succeeded in separating them. One of the most intellectual and gifted women of her time, Héloïse became prioress of the convent at Argenteuil, and later was abbess of a nunnery established by her husband. During her enforced and permanent separation from Abélard, she wrote letters to him which have been preserved with his. Héloïse survived the philosopher 22 years, dying near Nogent-sur-Seine in 1164. She and Abélard are now buried in one tomb in Père Lachaise Cemetery, Paris.

HELOTS, probably the original inhabitants of Lacadaemonia conquered and made serfs by the Spartans whom they always greatly outnumbered. They were attached to the soil and could not be sold from it, freed or killed by their personal master who acquired them with his estate. But the state could do any of these things; it therefore was always responsible for the helots but offered them no protection, punished them without trial, and exacted for the masters a percentage of their labors and income. Occasionally helots gained their freedom for some distinguished service or were even raised to high position as a means of preventing revolt. L. K. B.

HELSINGBORG or **HÄLSINGBORG,** a seaport city of Sweden, in the Malmöhus district, situated on the narrow sound, the Öresund, which divides Sweden from Denmark, about 30 mi. northwest of Malmö. Helsingborg is a pleasure resort, a busy port and one of the chief industrial cities of Sweden. It has extensive copper-works and breweries, and manufactures sugar, phosphates and India rubber. The chief exports are timber, paper, rubber and dairy produce. The city once belonged to the HANSEATIC LEAGUE. It has been Swedish since 1658. The Danes temporarily invaded the country in 1710. Pop. 1931, 55,299.

HELSINGFORS. *See* HELSINKI.

HELSINKI or **HELSINGFORS,** capital of the republic of Finland, a seaport situated on a tongue of land extending into the Gulf of Finland, is the largest city and cultural center of the country. There are harbors on three sides of the city. Helsinki consists of the old city and numerous newer sections. The inner city is located on the Esplanade, and on Alexander Street. On the Market Place near the south harbor is the president's palace and other monumental buildings. On the Senate Place to the north is the Lutheran St. Nicholas Church, the University of Helsinki and several government buildings. Towards the west is the railroad station, the Finnish National Theater and Aethenaeum with picture galleries. To the north is the fine park Kaisaniemi with a botanical garden. Kaivopuisto Park is located to the southeast with villas, a bathing beach and summer theater. In Tolo to the west and southwest are the parliament house and national museum. There are six other sections north of the old city. Helsinki exports large quantities of lumber and paper goods and imports grain, iron, machines, coal and groceries. There are some factories in the city and several shipping companies are established here. The city also has an institute of technology, an astronomical observatory and other educational institutions, libraries, theaters, concert halls and an opera house. In 1920 64.4% of the inhabitants were Finns and 33.9% Swede-Finns. Pop. 1930, 241,115.

HEMANS, MRS. FELICIA DOROTHEA BROWNE (1793-1835), English poet, was born at Liverpool, Sept. 25, 1793. She grew up in Wales, and when only 14 published some poems. Five years later her *Domestic Affections and Other Poems* appeared, and she now devoted herself to a literary career. She wrote works on art and history, made translations from Camoens and other poets, and produced many poems. Mrs. Hemans's reputation, however, is based chiefly upon several of her short poems. Among the best known of these are perhaps *Casabianca, Belshazzar's Feast, The Palm-Tree* and *The Tyrolese Evening Song.* But the poem which will probably preserve her reputation longest is *The Landing of the Pilgrim Fathers.* She died at Dublin, Ireland, May 16, 1835.

HEMATITE, the red oxide of iron, an extremely important ORE of that metal, and also used in jewelry and in the production of rouge. Crystallized hematite is black, but when massive it is reddish black to red. It is opaque, and usually has a fine metallic luster; when soft and massive it has an earthy appearance. Black, splendent hematite is cut for mourning jewelry. Hematite crystallizes in the HEXAGONAL SYSTEM.

Because of its abundance and the ease of reducing the oxide to metallic iron, this mineral is one of the principal ores of iron. One of the most important hematite mining regions is the Lake Superior country, where hematite is in banded, sedimentary beds composed chiefly of iron oxides, carbonates, silicates and silica, which are variously called JASPER, taconite, greenalite and ferruginous CHERT. This rock becomes commercial ore through the removal of silica and carbon dioxide by weathering. Other important regions of production are in Alabama, and in Norway, Sweden, England and France. Large, unexploited reserves exist in Brazil. *See also* ORE DEPOSITS; WEATHERING; OCHER; OOLITE; GANGUE.

HEMINGWAY, ERNEST (1898-), American novelist, was born at Oak Park, Ill., July 21, 1898, and educated in the public schools. He served in the World War with the Red Cross, first in France, and then on the Italian front, where he was severely wounded. His war and post-war experiences furnished material for much of his fiction. *The Sun Also Rises,* published in 1926, is concerned with certain phases of the aftermath of the war in Europe, and *A Farewell to Arms* developed out of the collapse of the Italian front in 1917. *In Our Time,* 1924, and *Men Without Women,* 1927, are collections of his short stories. Hemingway's style achieves an effect of extreme and vital naturalism. His account of bullfighting, *Death in the Afternoon,* was published in 1932.

HEMIPLEGIA, paralysis of one side of the body as a result of interference with the nerve tracts of

the brain which control the movements of the voluntary muscles. The injury may or may not be extensive enough to incapacitate all of the muscles of one side. At any rate, the muscles of the trunk usually escape. This is due to the fact that there the muscles of both sides usually act in combination and can be controlled from either side of the brain.

The three main causes of hemiplegia are brain hemorrhage (*see* APOPLEXY), brain softening, and brain tumors. Brain softening is induced by degeneration of brain tissue from loss of blood following THROMBOSIS AND EMBOLISM. From an observation of the muscles affected and the mode of onset, both the type of lesion and its exact location in the brain can usually be determined.

Hemiplegia usually clears up gradually, but there is frequently some residual PARALYSIS, especially of the hands and feet, and more particularly of the refined and complex movements. The end result depends upon the general condition of the patient, nursing care, and thoroughness of reeducation of the muscles.

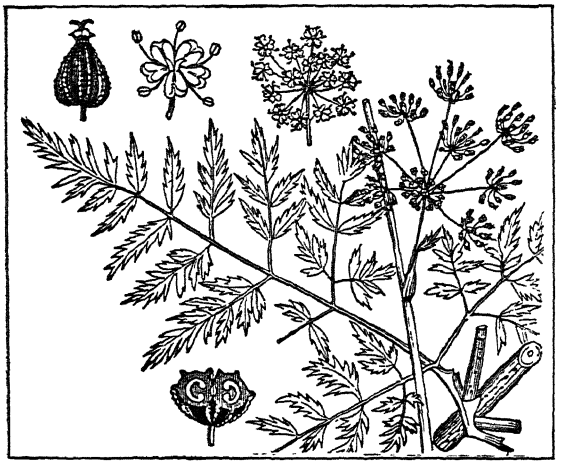
HEMIPTERA, the name for a large order of insects properly known as bugs. It includes two suborders, the HOMOPTERA and the Heteroptera, or Hemiptera proper. Some writers consider these two groups separate orders.

Most Heteroptera have curious forewings, leathery at the base, and membranous at the apex; the hind wings are membranous. A few are wingless. Some of them are aquatic; others are terrestrial, and some of the latter are serious plant pests. The more familiar species are the water-boatmen, the giant water-bugs, pond-skaters, the tarnished plant-bug, a pest on fruits, the chinch-bug, a grain and corn pest, the squash-bug, and bedbugs. A. I. W.

HEMITONE, in music, the half-tone or semitone based on the difference between the Pythagorean major third $\left(\frac{9}{8} \times \frac{9}{8} = \frac{81}{64}\right)$, and the perfect fourth $\frac{4}{3}$ Since $\frac{4}{3} \div \frac{81}{64} = \frac{256}{243}$, the last fraction is the numerical expression of the hemitone, the numerator and denominator standing respectively for the vibrations of the upper tone and the lower or, more generally, the ratio between those vibrations. It was an interval slightly smaller than the diatonic semitone, or minor second, in both JUST INTONATION and equal TEMPERAMENT, that is, slightly smaller than the interval E-F, but slightly larger than the chromatic semitone, or augmented prime (as from C-C♯) in pure tuning. *See* MUSIC: *Greek.*

HEMLOCK, the common name for a genus (*Tsuga*) of valuable timber and ornamental trees of the pine family. There are nine species, four native to North America and five to eastern Asia. They are tall pyramidal evergreen trees with cinnamon-red bark and handsome foliage. The slender horizontal or drooping branches bear graceful sprays of narrow flat leaves and small pendulous cones. The common hemlock (*T. canadensis*), which sometimes grows 100 ft. high, is found from Nova Scotia to Minnesota, southward to Alabama. The astringent bark is extensively used in tanning leather and the wood, though brittle and splintery, is made into coarse lumber. The much smaller Carolina hemlock (*T. caroliniana*) grows in mountains from Virginia to Georgia. The western hemlock (*T. heterophylla*), often 200 ft. high, and the mountain hemlock (*T. Mertensiana*) occasionally 150 ft. high, grow from southern Alaska to Montana and California. For lumber purposes the wood of the western hemlock is superior to that of all other American hemlocks, comparing favorably with pine and spruce. In 1930 the cut of western hemlock in Oregon and Washington amounted to 1,065,174,000 bd. ft., valued at the mill at $15,571,749.48 out of a total of 1,517,370,000 bd. ft., valued at $25,855,984.80 for all kinds of hemlock lumber cut in the United States. A. B. J.

HEMLOCK, POISON (*Conium maculatum*), a tall biennial herb of the parsley family, called also St. Bennet's-herb and spotted parsley. The plant, a native of Europe and western Asia, is widely naturalized as a weed in North America from Nova Scotia to California and also in Chile. It grows from 2 to 5 ft. high with a hollow, erect, much-branched stem, often marked with purple spots, finely divided leaves and large umbelled clusters of small white flowers. Various parts of the plant contain conine, a powerful irritant poison speedily causing paralysis, convulsions and death.



POISON HEMLOCK

Fruit, flower and umbellet (top), cross section of fruit (lower left), branch with part of stem, leaf, and flower cluster (umbel)

HEMOGLOBIN. *See* ANEMIA; BLOOD.

HÉMON, LOUIS (1880-1913), French author, was born in Brest in 1880, and educated there. After spending several years writing in London, he went to Quebec, Canada, in 1911, and worked as a laborer on a farm in order to study the rural people. There he wrote his outstanding novel, *Maria Chapdelaine.* Other works include *Colin-Maillard* and *Battling Ma-*

lone, Pugiliste. Hémon was killed by a train near Chapleau, Ont., July 8, 1913.

HEMOPHILIA, or **BLEEDERS' DISEASE,** an hereditary disease characterized by a marked tendency to prolonged bleeding because of the failure of the blood to clot normally. The disease is limited to the male sex but may be transmitted by the female who shows no evidence of the condition. Biblical and early medical history emphasize the hereditary and the sex-linked character of the disease. In the nineteenth century the information on hemophilia was formulated as the law of Nasse. This stated that the disease was limited to males and transmitted through unaffected females. Since these early observations, genealogical charts have been available which show how the disease has been transmitted for generations, according to the law of Nasse. The most classical of the genealogical surveys of hemophiliac families is that of Appleton-Swain, where there was a transmission of the hereditary trait to the seventh generation within a period of two hundred years.

Despite the early recognition of the disease and the subsequent scientific investigation, no satisfactory explanation as to its exact cause has been advanced. It is known that the bleeding tendency is due to the fact that hemophiliac blood clots slowly, but the factors responsible for delay in clot formation have not been definitely determined. Many theories have been advanced but no one explanation is universally accepted.

The main disturbance in the blood of a hemophiliac is in the delay of clot formation. The quality of the clot, once formed, is normal. Therefore, it is believed that all the elements necessary for clotting of blood are present, but that one is delayed in forming. The evidence at present points to the blood platelets as the responsible factor. Normally, when blood is shed, these small particulate bodies burst and liberate a substance which initiates the clotting process. In hemophilia Howell and other investigators have shown that there is a marked delay in the rupturing of platelets, and hence the delay in the clotting process.

The tendency to bleed may be manifested early in life or at birth. Cases are on record, however, where no familial or hereditary history is obtainable and bleeding starts at any time during the life history. This has been termed *sporadic hemophilia.* Once the disease is initiated, it differs in no way from the classical type.

The outstanding symptom of the disease is bleeding. This may be spontaneous or initiated by the slightest bruise or scratch. The bleeding may take place externally or internally. Some of the more common sites of bleeding are from the nose and mouth or into the bowell and joints (especially the knee). The bleeding may persist for hours or days. While continued loss of blood may temporarily render the patient weak and anemic, many hemophiliacs are able to follow ordinary pursuits of life. In some cases the tendency to bleed decreases with age.

At present no curative treatment is known. Preventive measures, such as education of the hemophiliac families in the principles of eugenics and protection of hemophiliacs from injury are practiced. The only hope of preventing the condition can be realized by advising women of known hemophiliac families against having children. In this way the hereditary tendency to bleed will not be transmitted. *See also* PURPURA HEMORRHAGICA. H. G. P.

HEMORRHAGE, the escape of blood from the blood vessels. The extravasation may take place through the intact blood vessel and the term *hemorrhage per diapedesin* is used. Where blood escapes through a ruptured blood vessel, it is called *hemorrhage per rhexin.* The bleeding may be external, on the free surface of the body, or internal, into the tissues or organs of the body, where it is spoken of as a concealed hemorrhage.

The effects of hemorrhage depend upon not only the amount of blood lost, but also upon the rate at which this loss occurs. The forces of the body that compensate for the loss of blood are efficient, but time is required for them to be brought into effect. Therefore, a sudden large hemorrhage is more serious than a greater loss of blood over a longer period of time. The first effect upon the body of a large hemorrhage is a fall in blood pressure. This is due to the reduction of the volume of blood brought to the heart and consequently the lessening of the output. But the body compensates for this by closing some of the blood vessels in parts of the body where the presence of blood is not so important. This is maintained until the volume of blood is made up. The next response is the increase in heart and pulse rate in an attempt to use the blood that is available to greater advantage.

The loss of red blood cells and its pigment, hemoglobin, is, however, not compensated so quickly. The transportation of oxygen is one of the chief functions of these cells and a sudden reduction in their number results in a general oxygen lack all over the body. This is especially marked if the individual in whom the hemorrhage has occurred does not put his body at absolute rest so as to decrease the need of oxygen. Even then certain symptoms of oxygen deficit will be manifest. Respirations may be shallow and rapid and a feeling of faintness and giddiness may be present.

The loss of blood from a vessel is followed by an immediate intake of fluid from tissues to make up the loss in blood volume. This response is so prompt that if one lost blood continuously from an artery the last portion of blood would be more dilute than the first. The more gradual the bleeding, the greater the opportunity for fluid from the tissues to get into the blood stream. The first restoration in blood loss is clear fluid. After a few days the salts are restored. This is evidenced by a rise in the specific gravity of blood. The proteins of the blood are next made up. The replacement of the last red blood cells and their pigment, hemoglobin, depends upon

the regenerative power of the red bone marrow. Normally there is daily improvement and complete restoration in one month. The lack of oxygen at the onset of the hemorrhage serves as a stimulus for increase in red bone marrow elements. Therefore, regeneration is most intense soon after the hemorrhage when the oxygen lack is the greatest. At this time, it is not uncommon to find young or immature forms of red cells in the blood as evidence of a hurried response to a sudden demand.

While the body will respond to hemorrhage with its own method of compensation, it is a slow process. The recovery can be greatly facilitated and hastened if the fluid from the tissues is spared and the lost fluid is replaced by a copious ingestion of water by mouth. Salts and water can be replaced by the injection of sterile salt solution of the same concentration of the blood into the tissue. BLOOD TRANSFUSION, with an equal amount of whole blood from a suitable blood donor, nullifies the effects of the hemorrhage immediately.

The response to hemorrhage decreases with each new one. Where there has been a repeated loss of blood, the body soon becomes exhausted and the response is inadequate. *See also* BLOOD: Platelets; APOPLEXY; PARALYSIS. H. G. P.

HEMORRHOIDS, the swollen or dilated veins of the rectum, commonly known as piles. The veins of the rectum are held in loose connective tissue, and therefore, lack support. When the pressure of the blood within these veins is increased, they are easily stretched.

The pressure of blood in these veins is low as long as the flow of blood through them is not blocked. When the vein is blocked, the pressure within it gradually rises. The act of defecation, that is, a bowel movement, particularly if difficult, prolonged and accompanied by straining, increases markedly the pressure within the veins of the rectum. Hence chronic constipation is a predisposing cause for piles.

Hemorrhoids are quite common in young males and less frequent in young women, although they often occur following pregnancy, when the enlarged womb and increased pressure in the abdomen may obstruct the flow of blood through the veins of the rectum.

Piles may be present without the individual being aware of them. When a clot of blood forms in one of the veins, it causes pain and tenderness. The clot forms as a result of irritation such as may come from the use of violent purgatives or by local exposure to damp and cold. If further irritation is prevented, the symptoms clear up. The clot can be removed by means of a slight surgical operation.

Piles are spoken of as external and internal. The external kind project through the anus, and appear as dark brown folds of skin. They usually cause no symptoms other than perhaps slight itching with minor discomfort immediately before and after a bowel movement.

The internal piles are covered with the mucous membrane that lines the rectum. At first they are held above the opening of the rectum, but later tend to protrude through the anus. They are prone to bleed. The internal type cause much more discomfort than the external variety.

Improving the general health and overcoming constipation may benefit internal piles. If pain, bleeding and other symptoms persist, the enlarged veins must be removed by surgical operation. Application of astringent substances in the form of a suppository may give some relief. W. I. F.

HEMP (*Cannabis sativa*), an important fiber plant of the mulberry family. The plant is a native of temperate Asia, which, through cultivation, has become widely naturalized in many parts of the world. Since remotely ancient times it has been grown for its fiber, being extensively planted in Europe, especially in Russia, and also in India. Due to the increased use of sisal, abaca, and jute, the cultivation of hemp in the United States, though formerly important, notably in Kentucky, has greatly declined. Besides its cultivation for fiber, hemp is grown for its seeds, which form a valuable food for poultry and cage birds and yield a useful oil, and also for its resin-bearing foliage and flowering tops used as an intoxicating drug.

HEMP FIBER, the true hemp of commerce, widely used in making coarse cloth, rope and cordage, is obtained from the bast in the stems of the hemp plant (*Cannabis sativa*). However, the fiber products of various other plants are known also as hemp, as manila hemp properly called abacá (*Musa textilis*), sunn hemp (*Crotalaria juncea*), sisal hemp, properly sisal (*Agave sisalina*), Deccan hemp (*Hibiscus cannabinus*), pita hemp (*Agave americana*) and bowstring hemp (*Sansevieria zeylanica*).

Hemp fiber is prepared in a manner very similar to that of flax. When the plants are mature they are pulled, tied in bundles and retted under water. When the fiber has been loosened, the stems are spread out to dry and bleach in the sun, after which the fiber is detached by scutching.

Hemp Manufacture. There are two distinct classes of fibers called hemp, the true or soft hemps and various hard CORDAGE fibers commercially called hemp. The soft or true hemps are prepared and spun upon similar but coarser machinery to that employed for flax (*see* LINEN), the numbering and twisting being identical. Italian hemp is the finest procurable, the best grades being stronger than flax in the proportion of 139 to 100. Cancas, though originally made exclusively of hemp, is now generally made of flax. Indeed, the hemp weaving industry as such can hardly be said to exist to-day being for all practical purposes merged in the linen industry in the coarse end of which hemp yarns are used to some extent either alone or in combination with linen yarns. Hempen yarns are still sometimes used as either warps or wefts in the making of carpets. Halter webbing and chair webs are also sometimes made from hemp yarns.

BIBLIOGRAPHY.—H. R. Carter, *Cordage Fibers;* T. Oakley, *The Spinning and Twisting of Long Vegetable Fibers.*

HEMPSTEAD, a village in Nassau Co., a residential suburb of New York City, situated on the western end of Long Island, N.Y., 23 mi. east of Manhattan. The village is a popular summer resort and a trade center; it is served by the Long Island Railroad. The chief local manufacture is airplanes. The retail trade in 1929 reached a total of $20,149,861. Nearby is Mitchel Field, a United States Air Corps training camp; Roosevelt and Curtiss Aviation fields are in the vicinity. Hempstead was settled by the Dutch in 1644 and was incorporated in 1853. The village has two fine old churches, Christ's First Presbyterian and St. George's Protestant Episcopal. Pop. 1920, 6,382; 1930, 12,650.

HENBANE (*Hyoscyamus niger*), a highly poisonous biennial herb of the nightshade family, called also fetid nightshade and hog bean. It is a native of Europe, naturalized in waste grounds from Nova Scotia to Michigan, and more or less cultivated for its leaves and flowering tops which are used medicinally. The plant grows about 2 ft. high with large, oblong, usually deeply lobed leaves and greenish-yellow, purple-veined flowers borne in one-sided clusters. Various parts of the plant contain hyoscyamine, a powerful narcotic alkaloid.

HENDERSON, ARTHUR (1863-), British Labor leader, was born at Glasgow, Sept. 15, 1863. He served at Newcastle as an apprentice moulder, and soon gained prominence in the trade-union movement. After a term as Mayor of Newcastle, he entered Parliament as a Labor member in 1903 and five years later became chairman of the Labor Party. Henderson was a member of the 1915 coalition ministry, and in 1917 visited Russia on behalf of his government. The next year he joined Ramsay MacDonald in seeking Labor support independent of coalition groups. When the first MacDonald ministry came into office in 1924, Henderson was appointed Home Secretary. He was Secretary of State for Foreign Affairs in the second MacDonald ministry, 1929-31, but refused to follow MacDonald in the formation of a national coalition government in the financial crisis of 1931. Instead he became head of the Labor Party in place of the deposed MacDonald, but went down to defeat with his party in the general election.

HENDERSON, WILLIAM JAMES (1855-), American music critic, was born at Newark, N.J., Dec. 4, 1855. He was graduated at Princeton University in 1876, and studied the piano with Langlotz. He was a member of the staff of the New York *Times* in 1883-1902, and in 1902 was appointed music critic of the New York *Sun*. He has been a musical lecturer and instructor, and has written numerous books on music, including *What Is Good Music? Richard Wagner* (1901), and *The Early History of Singing*.

HENDERSON, a city of northwestern Kentucky, the county seat of Henderson Co., situated on the Ohio River, 12 mi. south of Evansville, Ind., to which it is joined by a bridge. Two railroads, three highways, a ferry and bus lines afford transportation. Tobacco, corn, wheat and apples are raised in the vicinity, and oil and gas are produced. Three coal mines lie within the city limits. The chief local manufactures are cloth, furniture, tobacco products and boxes. The total value of manufactured products, 1929, was $4,118,916. In 1929 the retail business reached a total of $5,022,012. Henderson was settled in the latter part of the 18th century and incorporated as a city in 1854. Pop. 1920, 12,169; 1930, 11,668.

HENDERSON, a city in Vance Co. in northern North Carolina, situated 120 mi. southeast of Richmond, Va. Bus lines and two railroads serve the city. Tobacco and cotton are the chief crops of the region. Motor trucks, cloth, jute bagging and flour are among the principal manufactures. The city was founded in 1841; incorporated in 1853 and 1913. Pop. 1920, 5,222; 1930, 6,345.

HENDERSONVILLE, a city in western North Carolina and the county seat of Henderson Co. It is situated in the Blue Ridge Mountains, 22 mi. southeast of Asheville and is served by the Southern Railroad. The principal industries are canning factories, hosiery mills, creameries, and lumber mills. Trade in these industrial products and fruit and vegetables make Hendersonville an important commercial center. The city is a popular summer resort. It is the seat of the Blue Ridge School for Boys and the Fassifern School for Girls. Pop. 1920, 3,720; 1930, 5,070.

HENDRICKS, THOMAS ARMSTRONG (1871-), American educator, was born in Pulaski Co., Ky., Mar. 20, 1871. After graduating in 1897 at Centre College, he was superintendent of schools successively at Junction City from 1899-1905, at Versailles from 1905-08, at Cynthiana from 1908-13, and at Paris from 1913-18. In 1918-19 he served as president of Hamilton College, Lexington, and for the next two years was supervisor of country schools at Winchester, Ky. Hendricks was elected superintendent of schools at Winchester in 1921 and to the same office in 1923 at Berea, where he also became dean and professor of psychology at Berea College.

HENGELO, a city in the Dutch province of Overyssel, 8 mi. southeast of Zutphen, is a railroad center with large spinning and weaving mills, dyeing plants and railway repair shops. Pop. 1930, 34,328.

HENGIST and **HORSA,** two somewhat legendary chieftains of the Jutes who landed in Kent in 499. *See* ENGLAND.

HENLEY, WILLIAM ERNEST (1849-1903), British poet and writer, was born at Gloucester in 1849. In his youth he contracted tuberculosis, necessitating the amputation of one foot, and while ill in the hospital he wrote poems, descriptive of his experience, of such force and poignancy that they opened the way for his career in journalism and letters. He went to London in 1877 and during the next quarter-century edited several literary journals with distinguished success and wrote much verse and brilliant literary criticism. Among his many friends was JOSEPH CONRAD, whose literary career he was the first to encourage. Henley's first critical volume, *Views*

and Reviews, appeared in 1890. His fame rests almost wholly on his poetry, of which he published several volumes, including the *Book of Verse,* 1880, *The Song of the Sword,* 1892, and *Hawthorn and Lavender,* 1901. He experimented in complicated meters and unrhymed rhythms but is best known by his short poems of intense feeling. Henley died July 11, 1903.

BIBLIOGRAPHY.—K. Williamson, *W. E. Henley,* 1930.

HENNA (*Lawsonia inermis*), a tall shrub of the loosestrife family, native to various tropical regions and widely cultivated and naturalized. In India, Arabia and Egypt it has been grown as a dyeplant since remotely ancient times. It grows about 20 ft. high, bearing small oblong leaves and very fragrant, white or rose-red flowers. The leaves yield the famous orange dye called henna, widely employed in coloring hair and leather. In the Orient women use henna to stain their nails, a custom dating back to the time of the pyramids in Egypt.

HENNEPIN, LOUIS (c. 1640-c. 1706), Belgian missionary and explorer of the upper Mississippi Valley, was born at Ath, Belgium, about 1640. He became a Franciscan at an early age. In 1675 he sailed with other RECOLLETS for Quebec. A missionary among the Iroquois in 1677, in 1678 he joined the party of LA SALLE on its journey to the Mississippi Valley. From the site of Peoria, Ill., Hennepin and two others set out in 1680 for the northern reaches of the Mississippi. At St. Anthony's Falls they fell into the hands of the Sioux, but in 1681 were allowed to leave with DU LHUT, and returned to Quebec. In 1683 Hennepin published in France his *Description de la Louisiane.* He drew much unfavorable comment in 1697 when he asserted that he had explored the entire Mississippi to the delta in his revised edition of *La Nouvelle Découverte,* which was proved to be a plagiarism of Father Membre's narrative of La Salle's voyage of 1682. Stigmatized by the Franciscans, he spent the latter years of his life as an obscure monk, and died in Holland, about 1706.

HENRI, ROBERT (1865-1929), American portrait and figure painter, was born in Cincinnati, O., June 25, 1865. He studied for two years at the Pennsylvania Academy of Fine Arts (1886-88) before going to Paris, where the classicism of the Ecole des Beaux Arts failed to satisfy his sturdy individualism. Travel in Spain, Brittany and Italy developed his preference for realism. In 1891 he returned to Philadelphia, where he became a leader among the younger and more progressive artists. He taught for several years in New York, inspiring his pupils with his own love of truthful presentation and spontaneity. *The Art Spirit,* published by him in 1923, is a compilation of his occasional essays and his notes as a teacher. Among his highly successful works, notable for vitality and vivid color, are *The Spanish Gypsy* in the Metropolitan; *The Laughing Girl* in the Brooklyn Institute; and *The Young Woman in Black* in the Chicago Art Institute. The artist died in New York City, July 12, 1929.

HENRY I (1068-1135), surnamed "Beauclerc" King of England, was born in 1068, probably at Selby, Yorkshire. Though the youngest son of William the Conqueror, he practically seized the kingship on the death of his brother, William II, in 1100, while Robert, Duke of Normandy and rightful heir, was absent on a crusade. He defeated Robert at Tinchebrai in 1106, imprisoned him for life, and took possession of Normandy. He married Matilda, daughter of the king of Scotland, thereby winning favor with his Saxon subjects; the clergy were appeased by his recall of ANSELM, the exiled archbishop of Canterbury. He also restored the laws of Edward the Confessor. Henry I's reign was marked by a dawning consciousness of English nationality. He died near Rouen, Dec. 1, 1135.

HENRY III (1207-72), King of England, was born at Winchester on Oct. 1, 1207. He was the son of King John, whom he succeeded in 1216 at the age of nine, with William Marshall, Earl of Pembroke, as regent. His succession was challenged by the French Dauphin, Louis, who was defeated at Lincoln on May 20, 1217. In 1232 Henry assumed charge of the government. His mismanagement and the preferment given foreigners caused the barons to rebel in 1258. They forced him to sign the PROVISIONS OF OXFORD which he later repudiated, thus precipitating another rebellion under SIMON DE MONTFORT. Henry was defeated at the Battle of Lewes in 1264, and imprisoned until rescued by his son Prince Edward on Aug. 4, 1265. He died at Westminster, Nov. 16, 1272.

BIBLIOGRAPHY.—F. A. Gasquet, *Henry III and the Church.*

HENRY IV (1367-1413), King of England, was born at the castle of Bolingbroke near Spilsby, Lincolnshire, on Apr. 3, 1367, the son of JOHN OF GAUNT and Blanche of Lancaster. He was an able fighter and popular with the English people. In 1398 he was banished by RICHARD II. When in 1399 he succeeded his father as Duke of Lancaster, Richard II seized his estates. Henry returned to England in July 1399, while Richard was in Ireland. On Richard's return he was captured by Henry, imprisoned and forced by parliament to abdicate on Sept. 30, 1399. Henry was thereupon chosen king by parliament, the first king of the Lancastrian line and the first constitutional monarch. During the early years of his reign he crushed several attempts to dethrone him, chief among them a rebellion led by HENRY PERCY. Henry died at Westminster on Mar. 20, 1413.

BIBLIOGRAPHY.—G. M. Trevelyan, *History of England,* 1926.

HENRY V (1387-1422), King of England and oldest son of Henry IV, was born at Monmouth, England, in Aug. 1387. The ill-health of his father forced him into practical politics at an early age, and in 1410 he was in virtual control of the government. Historical evidence seems to discredit the story of his youthful excesses used by Shakespeare, and his traditional connection with Falstaff is supposed to have its origin in Henry's friendship with Sir John Oldcastle. Henry ascended the throne on Mar. 20,

1413, and almost immediately threw himself into the popular war with France, winning the battle of AGINCOURT in 1415. By the TREATY OF TROYES in 1420 Henry gained large sums of money, the French princess Catherine in marriage and the promise of the French crown on the death of Charles VI. The king died at Bois de Vincennes in France on Aug. 31, 1422.

BIBLIOGRAPHY.—R. B. Mowat, *Life of Henry V,* 1915.

HENRY VI (1412-71), King of England, only son of Henry V and Catherine of Valois, was born at Windsor on Dec. 6, 1421. When his father died the following year, the infant was declared King of England. After the death of his grandfather, Charles VI of France, Henry was crowned king of France on Dec. 16, 1431. Since the victory of Joan of Arc before Orleans in France had already weakened the English cause in France, Henry's marriage to MARGARET OF ANJOU in 1445 was not sufficient to regain his waning prestige in France. Popular discontent with his rule exhibited itself in Cade's Rebellion in 1450. After the birth of Henry's son, Edward, in 1453 the king lost his reason. A struggle for dynastic control ensued, commencing in 1455 and known in history as the WARS OF THE ROSES. The year 1461 found King Henry in prison, his wife and son fugitives, and Edward IV of the House of York placed on the throne through the agency of the powerful EARL OF WARWICK. Henry VI died in the Tower of London on May 21, 1471, slain, perhaps, by Richard of Gloucester.

BIBLIOGRAPHY.—M. E. Christie, *Henry VI,* 1922.

HENRY VII (1457-1509), first Tudor King of England, was born at Pembroke Castle, Wales, on Jan. 28, 1457, the son of Edmund, Earl of Richmond. As his minority occurred during the WARS OF THE ROSES, he was safeguarded from Yorkist intrigues against his life—he was the only heir to the Lancastrian claims—during the reigns of EDWARD IV and RICHARD III in Brittany. By promising to marry Elizabeth of York, daughter of Edward IV and heiress to the throne, he won the support of Richard III's enemies, and with them plotted an invasion of England to overthrow Richard. He sailed to England in 1485, and, picking up reinforcements on the way, marched to meet Richard near Bosworth. On Aug. 22 he encountered Richard, who had a large but disloyal army, and won the victory, the king being slain. He was crowned after the battle by his followers, and recognized by Parliament. He married Elizabeth of York in 1486, and placed the white and red rose on the insignia of the house of Tudor.

In 1487 he led national troops against an Irish force which supported the pretender, Simnel, and crushed it at Stoke. The attempt of a second pretender, Perkin Warbeck, in 1495 Henry also frustrated. He made a treaty with Flanders in 1496, the *Intercursus Magnus,* which stimulated commerce between England and Flanders. With astute diplomacy he married his son Arthur to Catherine of Aragon in 1501, and, when Arthur died, married his son Henry, later HENRY VIII, to Catherine; his daughter Margaret he married to JAMES IV of Scotland. In domestic affairs he followed the course of Edward IV, and gradually brought about the centralization of power in his own hands. He decreased his dependence on Parliament, and forced the nobles to accede to his demands. By depending on benevolences and taxes on the great landowners and by levying fines he avoided taxing the middle class, which was his main support, and requesting grants from Parliament. He encouraged commerce, sent explorers to uncharted regions, and by sponsoring commercial development enabled the merchant class to prosper. But his chief accomplishment was his reestablishment of order throughout the kingdom. He died on Apr. 22, 1509.

HENRY VIII (1491-1547), King of England, was born at Greenwich, June 28, 1491. He was the second son of HENRY VII. After the death of his older brother, Arthur, he was created Prince of Wales in 1503, and on Apr. 22, 1509 he succeeded to the throne. A few weeks later he married CATHERINE OF ARAGON, his deceased brother's widow. Precocious in intellect and skilled in bodily exercises, the young King was exceedingly popular, the more so because his lavishness and fondness for display contrasted strikingly with the rigid and parsimonious economies practiced by his father. For the first two years of his reign Henry seems to have given little attention to politics; then, in 1511, he was induced by the hope of recovering Guienne to join Ferdinand of Aragon, the Venetians, and the Pope in a league against France. The English expedition that went to Spain in the spring of 1512 accomplished nothing and returned home in the summer. The next year Henry himself led an army in France, where in brilliant but futile victories he regained the prestige lost by the earlier fiasco. During his absence the Scots invaded England and were defeated at Flodden, in the last great border battle. Finding that his allies were preparing to play him false, Henry made a separate peace with France in 1514.

For some 18 years, 1511-29, the burden of government rested mainly on the shoulders of THOMAS WOLSEY; but Wolsey was minister and not sovereign. Henry permitted no policy to be carried out except with his own knowledge and approval, and he had no hesitation in making ventures in the field of diplomacy unknown to Wolsey. After the death of the Emperor Maximilian, 1519, Henry had his name suggested to the electors, but their choice fell on the King of Spain who became the Emperor Charles V. The consequent contest between the Emperor and Francis I of France, who also had been a candidate in the imperial election, was for years an important factor in English policy.

At the outbreak of the Lutheran reformation Henry ranged himself among the champions of orthodoxy by publishing a *Defense of the Seven Sacraments against M. Luther,* for which he received from the Pope the title Defender of the Faith, still borne by

English sovereigns. Possibly without strong religious convictions, Henry was a theological conservative and he made only such use of the new teachings and of the men who accepted them as served his royal purpose. The story of his own breach with Rome is intertwined with that of his matrimonial infelicities. As early as 1514 Henry had considered the possibility of having his marriage annulled; but altered circumstances and the expectation of an heir caused him to put aside the thought. Though the Queen gave birth to several children all save one, Mary, died; and Henry was faced with the likelihood of leaving a disputed inheritance. His want of an heir is a sufficient explanation for Henry's endeavor to secure the dissolution of his marriage to Catherine. At the King's instigation a collusive suit was started in Wolsey's legatine court in May 1527. In the autumn of the next year another cardinal was sent from Rome to try the case. A few hearings were held in the spring of 1529; then the cause was revoked to Rome. Wolsey's failure to secure the divorce was fatal; in Oct. 1529 he was deprived of the great seal, and a layman, Sir Thomas More, was made lord chancellor in his stead. The next month a Parliament was called which enacted in several sessions a series of measures, the cumulative effect of which was to separate the English Church from communion with the papacy. The clergy recognized the King, in 1532, as Supreme Head of the Church "so far as the law of Christ allows"; appeals and the payment of annates and like dues to the court of Rome were forbidden; papal interdicts and excommunications were declared void in England. The Act of Supremacy, 1534, was little more than authoritative recognition of an accomplished fact.

In May 1533 a court presided over by the Archbishop of Canterbury annulled the marriage of Henry and Catherine. When a little later the papal court decided in Catherine's favor the decision was without effect in England. Already the King had gone through the form of marriage with Anne Boleyn. His infatuation for her had been not a main cause for his repudiation of Catherine, but an incident; and when Anne lost the King's favor and failed to give birth to an heir she, too, was set aside. The archbishop's court pronounced Henry's second marriage invalid; and in May 1536 Anne was beheaded for infidelity.

Apart from the abolition of the papal jurisdiction, in which virtually all the clergy as well as the laity acquiesced, Henry's principal alteration in Church matters was the dissolution of the monasteries. A chief result of this step, which enriched the King and his adherents, was the disappearance of the mitred abbots from the House of Lords, which thus became a predominantly lay body. Henry VIII was no Protestant; the reformation in his reign was one of ecclesiastical polity, not of doctrine; heresy and the denial of the royal supremacy were alike punished with death. His success was due largely to the fact that the country shared his belief in the need of a strong monarchy, while the King identified his own aims with the nationalistic aspirations of his people. In his later years the King's policies fluctuated somewhat. After the death of his third wife, Jane Seymour, his marriage to Anne of Cleves, which soon ended in a divorce, suggested a *rapprochement* with the Lutherans; his fifth wife, Catherine Howard, was a conservative. She was beheaded for infidelity. Henry looked again toward the reforming party; and he may have been contemplating further changes when he died in 1547, survived by his sixth wife, Catherine Parr.

Ever careful to clothe his acts with due form of law, Henry was responsible for enlarging greatly the power of Parliament and its privileges, while he made much use of extraordinary tribunals such as the Court of Star Chamber. The origin of English naval power is best found in the last years of his reign and may be attributed to Henry's own interest in maritime affairs. The authority of the central Government in domestic matters and English prestige abroad were both enhanced by Henry's practical aptitude and ruthless vigor. He was utterly unscrupulous in his dealings, heartless in his treatment of his friends, cruel to any who opposed his will. He occupies an almost unique place among English sovereigns, not because of the blood and lust that marked his reign, but because he personally was so largely responsible for the significant developments that took place while he was on the throne. Henry died on Jan. 28, 1547, and was succeeded by Edward VI, his son by Queen Jane Seymour. A. H. S.

BIBLIOGRAPHY.—J. S. Brewer, *Reign of Henry VIII,* 1884; R. B. Merriman, *The Life and Letters of Thomas Cromwell,* 1902; J. Gairdner, *The English Church in the 16th Century,* 1904; A. F. Pollard, *Henry VIII,* 1905.

HENRY, the name of four kings of France. Henry I (1008-60) was the grandson of Hugh Capet. Ascending the throne in 1031, his reign was marked by a series of uprisings of his various vassals who were independent in all but name. The king's power was restricted to his hereditary estates in the Isle de France. Henry II (1519-59), son of the house of Valois and son of Francis I, succeeded his father to the throne in 1547. In 1531 he married Catherine de Medici, whose influence dominated the reign of his son Henry III. An ardent Catholic, Henry II was intolerant towards the Protestant movement. Royal authority was greatly enhanced and it was he who was responsible for the establishment of the Chambre Ardente. With the help of German Protestants he succeeded in establishing the French claim to the bishoprics of Toul, Verdun, and Metz, in 1552. It was during his reign, in 1558, that England lost Calais and Guines, her last possessions on the Continent. Politico-religious struggles characterized the reign of Henry III (1551-89). It was under the inspiration of his mother Catherine de Medici that the Massacre of St. Bartholomew occurred in 1572. Henry's reign was characterized by corruption and scandal, ending in the murder of Henry of Guise and

his brother the cardinal, at Blois, Dec. 23, 1588. This act finally cost the king his own life. HENRY IV of Navarre (1553-1610) was the first of the Bourbon kings.

HENRY IV (1553-1610), King of France and of Navarre, was born at Pau, Dec. 14, 1553, son of Antoine of Bourbon, duke of Vendôme, and Jeanne d'-Albret, Queen of Navarre. At his mother's wish, he joined the Protestant camp and aided in the 3rd Civil War. In 1569 he was proclaimed chief of the Huguenots. He married Margaret of Valois, sister of Charles IX in 1572. The same year Queen Jeanne died, and Henry became King of Navarre. His Protestantism imperiled his succession to the throne of France, after the death of the Duc d'Anjou, 1584, made him presumptive heir to the crown, and to realize his claims, Henry resorted to arms. In 1587 he defeated the army of the Catholic League at Coutras. Henry ascended the throne in 1589, following the assassination of Henry III. He defeated the Catholic armies again at Ivry in the same year, but convinced that his Protestantism made a peaceful reign impossible, he unexpectedly professed Catholicism in 1593, and was popularly acclaimed king. He sanctioned the EDICT OF NANTES, 1598, extending protection to Huguenots, and diminished the national debt. The king fostered the economic development of France, which in his reign enjoyed unprecedented prosperity. He was assassinated at Paris, May 14, 1610.

HENRY, name of seven German kings and emperors. HENRY I, the Fowler (876-936), Duke of Saxony, elected king in 919, defeated the Slavs and Hungarians, consolidated the German states, organized the army and laid the foundations for the Holy Roman Empire of the German nation. HENRY II (973-1024), the last emperor of the Saxon house, was elected in 1002, and, despite opposition which frustrated his plans to exercise the imperial power in the manner of Otto the Great, he was crowned Emperor at Rome in 1014. HENRY III (1017-1056), of the Salic house, was elected king in 1026, met with great opposition from the nobles of his own court, and was not crowned emperor until 1039, after he had deposed three popes and seated his own candidate. HENRY IV (1050-1106), son of Henry III, was temporarily removed from power by his dissatisfied princes and Gregory VII. He placated the Pope at CANOSSA and later forced him into exile. HENRY V (1081-1125), son of Henry IV, revolted against his father, whom he imprisoned and forced to abdicate. He was elected emperor in 1106, quarreled with the Pope over the right of investiture, and later invaded Holland. He was the last of the Salic house. HENRY VI (1165-97), son of FREDERICK BARBAROSSA, intelligent, strong willed and well educated, planned to establish a hereditary monarchy for the Empire, but this proved premature. HENRY VII (1269-1313), founder of the Luxemburg line of rulers, was elected in 1308 and crowned at Rome in 1312. In an attempt to consolidate the empire he went to Italy at the head of an army, and died near Sienna enroute to attack Naples.

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HENRY III (1017-56), of the Salian line of emperors, succeeded his father, Conrad II, as German king at the age of 22. Already in his own right duke of all the German duchies except Saxony and Lorraine, he dreamed of transforming a feudalized Germany into a national monarchy. To this end he set up a permanent capital at Goslar and constructed a series of strong castles to overawe the Saxons. His legislation, which he enforced rigidly, also tended toward absolutism. German influence at the Bohemian court dates from his successful war against Bohemia. Sincerely religious, his marriage to Agnes of Aquitaine inclined him to favor the Cluny reform movement, a policy fraught with disastrous consequences to the empire later. He attempted to stop simony, but succeeded only in diverting his income from this source into the pockets of his officials. A triple papal schism in 1045 gave him an opportunity to control the papacy. An Italian synod summoned by him deposed all three popes, and Henry appointed a series of German popes. Supreme in Germany, master of Italy and the papacy, Henry's work of consolidation was cut short by his early death and undone by the subsequent troubles with Saxony and the papacy. W. I. B.

HENRY IV (1050-1106), German King and Emperor, was born at Goslar in Prussia, Nov. 11, 1050. When his father, Henry III, died in 1056, the young Henry fell heir to the infinite perplexities of imperial rule and kingly power over the realms of Germany, Italy and Burgundy. His troubles began with the revolt of the Saxons who appealed to Pope Gregory VII in 1073 for assistance. In 1075 Gregory reasserted the papal prohibition of lay investiture, dispatched envoys to Henry, and demanded under the threat of excommunication complete submission on his part. Henry responded by summoning the Council of German bishops at Worms, in 1076, at which Gregory VII was declared deposed. This move Gregory answered by excommunicating and deposing Henry. The German princes conceiving this to be a favorable opportunity to curb royal pretensions, withheld their support from Henry, and forced him temporarily to make a humiliating submission to the Pope at Canossa in 1077. Gregory absolved him, but left the matter of his reinstatement as a king to the decision of a later council. The German princes chose a new king, civil war ensued, and Gregory once more excommunicated Henry. This aroused the German clergy to the defense of Henry, and a reversal of fortune followed, leading to his triumph over Gregory. Rome fell into Henry's hands, Gregory was expelled to die soon after, and a more agreeable pope was chosen.

The score or so of years that remained to Henry were spent in unending efforts to assert his royal authority both in Germany and Italy against revolts that flared up on all sides. In 1090 the Lombard

cities of Italy formed their first successful league against imperial power. After seven years of an unsuccessful offensive against a united Italian opposition he returned to find civil war raging among his rebellious vassals led indeed by his own son. Treason, abdication, and finally death at Liege Aug. 7, 1106, put an end to this most unhappy career after a half century of struggle with papal domination on one hand and the feudal particularism of his vassals on the other.

HENRY, JOSEPH (1797-1878), American scientist, born at Albany, N.Y., Dec. 17, 1797. In 1826 he became professor of mathematics and natural philosophy at Albany Academy and began experiments in electromagnetism. He greatly improved the electromagnet of Sturgeon by using insulated wire and winding it in several layers, instead of one loose layer, about the core. Shortly afterwards he adapted it to the telegraph and succeeded in transmitting signals through a wire a mile long. Henry discovered the self-inductive action of the soil and of the long conductor, presumably in 1830, although he failed to publish the fact until after Faraday had made public a similar discovery. He also developed a simple type of electric motor about this time. In 1832 he became professor of natural philosophy at the College of New Jersey, Princeton. While there, Henry developed the electromagnetic relay, demonstrated that an inducted current could be made to induce a current in another conductor, invented high and low-resistance galvanometers, discovered the oscillatory nature of the electric discharge, studied solar radiation and sun-spots and investigated capillary action and cohesion in liquids. In 1846 he left Princeton to become the first secretary and director of the Smithsonian Institution, which he organized. At the Institution, he sponsored, among other important projects, the transmission of weather reports by telegraph and the forecasting of storms from that data. It was largely through his influence that the Weather Bureau was formed. In 1852, he became member, in 1871 president, of the Light House Board. He was the recipient of many honorary degrees and offices, being made a member of the American Philosophical Society in 1835. Henry died at Washington, D.C., May 13, 1878.

HENRY, O. *See* PORTER, WILLIAM SYDNEY.

HENRY, PATRICK (1736-99), American revolutionary leader and orator, was born at Studley, Va., May 29, 1736. He became a noted lawyer and in 1765 he was elected to the Virginia House of Burgesses, where he drew up the "Virginia Resolutions" opposing the Stamp Act. He was a delegate to the First Continental Congress, 1774-75. In 1775 he made, before the Virginia Convention, the speech with its famous climax, "Give me liberty or give me death!" In 1776 he became Governor of Virginia, and was re-elected in 1777 and 1778, and again for the years 1784-86. Henry refused to be a delegate to the Constitutional Convention which met at Philadelphia in 1787 to revise the Articles of Confederation. In 1788 as a delegate to the Virginia convention to ratify the Constitution, he was one of the leaders of the anti-Federalist opponents of ratification, but despite his spirited speeches the convention ratified the Constitution. After membership in the Virginia Legislature, 1787-90, he retired from politics to the enjoyment of a fortune which he had gained in land and currency speculation. He later became a Federalist but refused many offices which were tendered to him. He died at Red Hill, Va., June 6, 1799.

HENRY, WILLIAM (1775-1836), English chemist, was born at Manchester, Dec. 12, 1775. He studied medicine at Edinburgh until 1795 and thereafter conducted chemical research on his own account. He was the author of a widely used text book of general chemistry but his chief fame rests on his discovery of what is called Henry's law, that the quantity of gas soluble in a liquid is proportional to the partial pressure. Henry died at Pendlebury, Sept. 2, 1836.

HENRY E. HUNTINGTON LIBRARY AND ART GALLERY, the former mansion and collection of books, paintings and objects of art of HENRY EDWARDS HUNTINGTON. It is located at San Marino, Cal., a suburb of Pasadena. In 1922 Huntington deeded to the American public his library and works of art, considered by many authorities to be the finest private collection in the world. His gift included the mansion in which they were housed and a trust fund of $8,000,000 to be used for further additions, research and publications.

The Huntington Library is especially rich in Americana, in manuscript literary material, and in rare editions of early English literature. Among the highly prized items are the manuscript of Chaucer's *Canterbury Tales,* a Gutenberg Bible, a number of the earliest Caxtons, some first editions of Shakespeare, and the manuscript of Benjamin Franklin's *Autobiography.* The art collection contains Gainsborough's *The Blue Boy* and other notable English portraits. There is also a valuable collection of tapestries, furniture, rugs, porcelains and bronzes.

HENRY THE LION (1129-95), Duke of Saxony and Bavaria and son of Henry the Proud, was born at Regensburg in Wurttemberg in 1129. When his father died in 1139, Henry did not immediately inherit his father's domains. He was invested Duke of Saxony in 1142. It was not until 1156 that he succeeded in acquiring the duchy of Bavaria through the assistance of the Emperor, Frederick Barbarossa. (*See* FREDERICK I.) It is for his achievements in Saxony that Henry has secured a niche in the halls of fame. He conquered the lands along the shore of the Baltic and consolidated the territory between the Elbe and the Oder. He encouraged the colonization of new towns, and took an active interest in the economic life of the old ones. He established a number of new bishoprics, and, as a Guelph or member of the Welf family, he led the states rights opposition in Germany to the unifying imperial policy of Frederick I of Hohenstaufen. Henry's defiance of

the Emperor and his subsequent refusal to appear before the Diet to answer for his disobedience meant rebellion, and in the struggle that ensued Frederick was completely the victor. Henry lost the duchy of Bavaria, was forced to submit to the dismemberment of Saxony, 1181, while Frederick's imperial prestige was considerably strengthened. Henry was permitted to retain Brunswick, where he died, Aug. 6, 1195.

HENRY THE NAVIGATOR (1394-1460), Prince of Portugal, patron of maritime exploration, was born at Oporto, Mar. 4, 1394, the fifth son of John I. The dominant objective of Henry's life was discovery and though he himself never put to sea his work and patronage were of great value in the maritime exploration of the 15th and 16th centuries. He established an observatory and school at Sagres near Cape Vincent where young noblemen were trained in all fields of navigation. Pupils of this school pushed further and further down the unknown coast of Africa as far as the 15th parallel of north latitude. They discovered Madeira, rounded Cape Bojador, explored portions of the Senegal and Gambia rivers, and discovered the Cape Verde Islands. Henry died at Sagres, Nov. 13, 1460, but the impetus he had given to navigation survived and eventually led to the discovery of the Cape of Good Hope and a new trade route to the Indies.

HENRYETTA, a city in Okmulgee Co., situated in eastern Oklahoma about 100 mi. east of Oklahoma City. Two railroads serve the city. There is a municipal airport. The chief crops of the vicinity are cotton and small fruit; livestock also is raised. Henryetta is a market for farm produce and also the mineral resources of the region which include coal, zinc, natural gas and petroleum. The principal industries are smelting, the making of gasoline and carbon and cotton ginning. The city was founded in 1900 and incorporated in 1903. Pop. 1920, 5,889; 1930, 7,694.

HENRY LETTERS, documents purchased by President Madison in 1812, for $50,000, from secret service funds, from John Henry, an Irish adventurer, and represented to contain evidence of duplicity and hostility toward the United States on the part of the Canadian Government. The documents revealed that Sir James Craig, Governor of Canada, had in 1809 been convinced that the New England states would shortly secede from the Federal Government, and had sent Henry to Boston to ascertain how far in that event the New England states would be disposed to look to England for assistance. Beyond this revelation there was nothing of significance in the collection. Madison transmitted the documents to Congress, Mar. 9, 1812, where the WAR HAWKS attempted to magnify their significance.

HENRY'S LAW, a principle of physics which states that the concentration of the saturated solution of a gas, the mass of the gas which a liquid will hold, is proportional to the pressure at which the gas is supplied; named after WILLIAM HENRY, a British chemist. When a gas is led through, or confined above, a liquid at a definite pressure, the gas dissolves in the liquid until a state of equilibrium is reached, i.e., until the number of gas molecules passing into the liquid per unit of time is just equal to the number leaving the liquid in the same time. The liquid is then saturated with the gas to a degree determined by Henry's Law. E. J. M.

HENRYSON, ROBERT (c. 1425-1506), Scottish poet, was born about 1425. He was a schoolmaster and notary public at Dunfermline, and achieved fame for his sequel to Chaucer's *Troilus and Cressida,* which he named, *Testament of Cresseid.* In extending the Chaucerian tale, he achieved such success that his poem was included in the earlier editions of Chaucer, as though it had been the work of that poet. (*See also* CHAUCER, GEOFFREY.) Henryson's *Robene and Makyne,* the earliest known example of pastoral poetry in his native language, a number of delightful lyrics, and his metrical translation of *Aesop's Fables* are noteworthy among his works. The poet died about 1506.

HENSCHEL, SIR ISIDOR GEORGE (1850-), German-Polish composer and conductor, was born at Breslau, Feb. 18, 1850. After studying at the Leipzig Conservatory he pursued a vocal career for several years. In 1881 he visited the United States, serving as first conductor of the Boston Symphony Orchestra for three years. He settled in London where he became a naturalized British subject. In 1886 he founded the London Symphony Orchestra which he conducted for 10 years. He was knighted in 1914. He composed numerous songs, an oratorio, a requiem, a Stabat Mater, and two operas.

HENTY, GEORGE ALFRED (1832-1902), English author, was born at Trumpington, near Cambridge, in Dec. 1832, and educated at Caius College, Cambridge. As a newspaper correspondent he reported the Austro-Italian War in 1866, and the Franco-Prussian War in 1870. In middle life he became editor of *Union Jack,* a boy's magazine, to which he contributed several serials. This was the beginning of the series of 80 Henty books for boys which became widely popular. Henty died in Weymouth Harbor, Nov. 16, 1902.

HENYA, one of the sub-tribes of the TLINGIT, living on the west coast of Prince of Wales Island, Alaska, between Tlevak Narrows and Sumner Strait.

HEPATICA, one of the earliest and most attractive wild flowers of eastern North America. There are four species, closely allied to the anemones, two of which are found widely in woods in the eastern states and Canada. They are low silky-hairy perennials, with three-lobed, evergreen leaves and short flower-stalks, bearing lustrous blue, purple or white flowers, closing and drooping at night. The two North American kinds, the round-lobed hepatica (*H. americana*) and the sharp-lobed hepatica (*H. acutiloba*), which differ chiefly in the shape of the leaf-lobes, are often found growing together, though the latter is the more common west of the Alleghenies.

HEPBURN, JAMES CURTIS (1815-1911), American medical missionary, was born in Milton, Pa., Mar. 13, 1815. He graduated at Pennsylvania University medical school and in 1840-46 served as a medical missionary in China. In 1859 he went to Yokohama, Japan, where he stayed thirty-three years. His medical work included training many young Japanese as physicians and in addition he wrote a grammar of the Japanese language, compiled an English-Japanese dictionary, and translated the Bible into Japanese. He died in 1911.

HEPBURN ACT, 1906, a statute designed to strengthen and augment the powers of the INTERSTATE COMMERCE COMMISSION. Frequent circumvention of the ELKINS ACT had come to the public knowledge; Pres. Roosevelt in his annual message of Dec., 1904, stressed the need of corrective legislation, but the Senate delayed enactment until June 29, 1906. The act abolished free passes save for railroad employees; forced the carriers to adopt a common accounting system; enlarged the authority of the commission to include pipe lines, and express and sleeping-car companies; and authorized the commission, upon complaint of a shipper, to fix "just and reasonable" rates and regulations for common carriers. The burden of initiating a court review of the reasonableness of a ruling of the commission was transferred to the railways.

HEPHAESTUS or **HEPHAISTOS,** in Greek mythology, the god of fire, identified with the Roman VULCAN.

HEPPLEWHITE, GEORGE (d. 1786), English cabinet-maker and furniture designer, was born possibly in the parish of St. Giles, Cripplegate. Of the date of his birth and his early life nothing is known other than that he served his apprenticeship in the shop of Gillow at Lancaster. The influence of Hepplewhite furniture began to be felt in England in the 1760's. Hepplewhite's work, in distinct contrast to the rococo and early Georgian styles of THOMAS CHIPPENDALE, was dainty, classic, extremely fragile in appearance, and was painted and inlaid rather than carved. His chairs are noted for their shield- and heart-shaped backs and for their unusually slender legs, often delicately fluted or reeded. The spade foot is another characteristic of Hepplewhite furniture. The designer's fame was established by his book, *The Cabinet-Maker and Upholsterer's Guide,* published posthumously in 1788. After Hepplewhite's death his widow, Alice, conducted the business under the name of A. Hepplewhite & Co.

HEPTARCHY, the term used to designate the organization of England from 449 to the 9th century, on the assumption that it was always composed of seven kingdoms: Northumbria, Mercia, East Anglia, Essex, Kent, Sussex and Wessex.

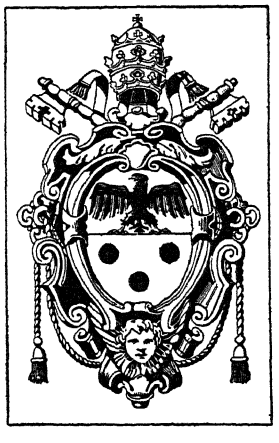
HERA, in Greek mythology, the queen of heaven, called by the Romans JUNO.

HERACLEA, an ancient city of Lucania in southern Italy on the River Siris. It was founded in 432 B.C. by Greeks from Tarentum and Thurii. Here it was that the Greek states during their independence in the south of Italy met in congress. In 89 B.C. Heraclea became a Roman colony. In 1753 a bronze copy of the *Lex Julia Municipalis,* the principal source of modern knowledge of Roman municipal law, was discovered here.

HERACLIUS (c. 575-642), Emperor of the East, was born in Cappadocia about 575. He early became a general in his father's army, and was entrusted with the expedition against Constantinople. As a result of his success in this campaign he was made Emperor in 610. Finding both the army and finances in a deplorable state, he immediately set himself to the task of reorganizing the state. Finally, with the help of the Church, he succeeded; but the task was a stupendous one. His accomplishment was noteworthy, for it was his work that largely saved the empire in the East for a period of time. His brilliant successes in Armenia, beginning in 622 and ending in 627 with his advance to the Tigris plains, held back the Persians. But in later years he was not so successful in stemming the Saracen tide, for it was during his reign that Egypt, Palestine, and Syria were overrun by the Moslems. Engrossed in theological studies, apparently he made no effort to stop these advances. Thus his career is somewhat of an enigma. He died in 642.

HERAKLEION. *See* CANDIA.

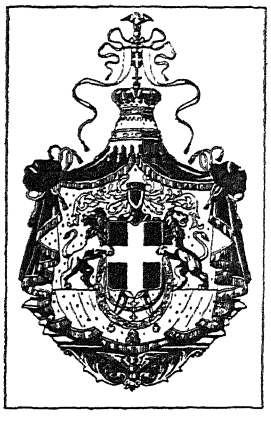
HERALDRY, from its proper sense as applied to the art and duties of a herald, has come to be the accepted term for the science of armorial bearings. The origin of heraldry is uncertain. Emblems were used by warriors as decorations and badges of distinction in different parts of the world from the earliest ages, but armorial coats, in the strict sense of the word, were not in general use until much later. The study of heraldry is in many respects like the study of a language. It was a method of picture-writing, used at a time when the reading of the written word was a comparatively rare accomplishment. During the crusades, when each knight had to have some identifying mark, the use of armorial insignia became general. The advent of complete body armor at the end of the 12th and early in the 13th century brought with it the full development of heraldry. A knight or leader completely sheathed in mail had to wear on his helmet or shield a distinguishing sign by which his men could recognize him and follow him into battle.



PAPAL COAT OF ARMS

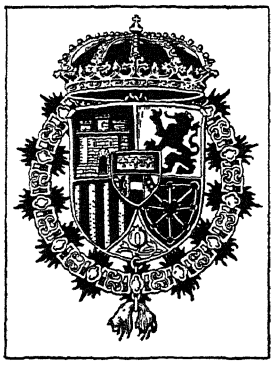
A secondary kind of heraldry, which consisted of badges and cognizances, was designed for retainers to show to which house or family they belonged. These

devices were generally sewed or embroidered on some portion of the retainers' garments. Cities, corporations, guilds and mercantile bodies also had their coats of arms. Legal papers conferring grants of land and other possessions were always stamped with the seals of their owners and this custom has caused to be preserved many coats of arms that otherwise would have been completely lost. As coats of arms became more and more numerous, duplicates resulted. To avoid this confusion, rules were formulated and a system was established. This systematizing continued throughout the 13th century, until heraldry was recognized as a distinct science.



COAT OF ARMS OF THE ROYAL FAMILY OF ITALY

The next 300 years formed the most admirable period of heraldry from the artistic point of view, to be followed by the decadence which overtook all arts and crafts in the 17th century. The shield or escutcheon is the base upon which the heraldic design is built up. Another device, called the crest, was worn on the knight's helmet. This was generally in addition to and different from that of the shield. His mantling, the veil of cloth which hung from his helmet over his shoulders, was also ornamented. The grouped composition of shield, helmet, crest, and mantling is known as an Achievement of Arms. The Herald College or College of Arms of London was incorporated in 1483 and the entire arms of the British kingdom were placed under its exclusive supervision and control.



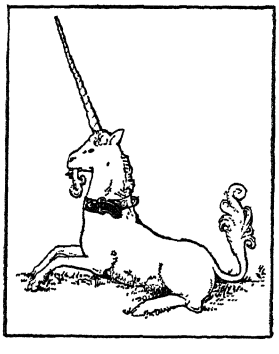
COAT OF ARMS OF THE KINGS OF SPAIN, LAST USED BY ALPHONSO XIII

The surface of the shield is known as the field, and the various devices placed upon the field are called charges. The description of the shield is termed blazoning. The field is divided into nine points known technically as: A, the dexter chief point; B, the middle chief; C, the sinister chief; D, the honor point; E, the fess point; F, the nombril point; G, the dexter base point; H, the middle base; and I, the sinister base. The color of the shield, known as "tincture," may be metal, true color, or fur. The metals used are "or," gold, and "argent," silver. The colors, red, blue, black, green, and purple, are known as gules, azure, sable, vert, and purpure. Colors are designated in black and white heraldic engravings by shading. Of the metals "or" is represented by small dots and "argent" by a plain field. The furs are "ermine" and "vair," the former being indicated by black tails on a white field, the latter by oblong patches of blue and white in horizontal rows. The charges contained on the field are known as ordinaries, and common charges. There are nine honorable ordinaries, known as the chief, occupying one-third of the field at the top; the pale, a vertical stripe in the center of the shield; the bend and the bend sinister, diagonal stripes; the fess or fesse, a horizontal stripe in the center; the bar, a narrower stripe, never placed in the center and seldom used singly; the chevron, a pair of diagonal stripes meeting in the middle; the cross; and the saltire, a diagonal cross.



ROYAL ARMS OF GREAT BRITAIN

In addition to the honorable ordinaries and their diminutives, there are other devices known as subordinaries, and many combinations and variations of these charges. The common charges are the figures used as symbols on the shield. These frequently were taken from birds and beasts, trees, leaves and flowers, and imaginary creatures. Of the heraldic animals the lion was the most frequently used. It was adopted as the emblem of the King of England, and many other sovereigns. Of the floral charges, the French fleur de lis is the best known. The common charges were also distinguished by their attitudes. Certain principles regulate the attitudes, the tinctures, and the disposition of every part of an armorial achievement.



THE FABLED UNICORN, OFTEN USED IN COATS OF ARMS

The marshaling of arms is the combining of several coats of arms belonging to one family or office on one escutcheon. The most common method of marshaling arms is by quartering or dividing the shield into quarters. The scroll, usually placed above the crest or below the field, carried the *motto* of the family and usually alluded to the family's distinction, either on some field of battle, in connection with some memorable event or a moral axiom which determined their conduct.

HERAT, a fortified city of AFGHANISTAN, because of its position as a central point on the routes to India, Persia and the Caspian Sea, called the "Key of India." It is situated at an elevation of 3,000 ft. above the sea near the Heri River, 360 mi. west of KABUL. Herat is enclosed by a wall with towers and is entered by five gates. The city occupies an area of 1 sq. mi. and has narrow crooked streets,

shops and caravansaries. Herat was at one time a flourishing trade center for products of India, China, Persia and Afghanistan, and the city is still a center for caravan routes to east, west, north and south. Blades, silks and sheepskin caps and cloaks are manufactured here. Rose water is also produced in considerable quantities. The commerce is chiefly in the hands of Hindus. The province of Herat is rich in the growing of grain and fruits, especially grapes. The horses of the region are particularly noted.

Herat, once known as Alexandria Arion, was captured by the Arabs in the 7th century. In the 18th century the Afghans won the city from the Persians. Since then except for a short period in the 19th century, when it was an independent city, Herat has been an Afghan city. Est. pop. 1931, 121,000.

HERB, a plant with little or no woody tissue, no winter buds above ground, and consequently one that dies down to the ground at the end of the growing season. Most herbs, however, persist for many years because they have underground buds borne on such stem structures as bulbs, rootstocks or tubers. Such perennials far outnumber the biennial herbs which complete their life cycle in two years, or the annuals, which live only a single season. Herbs apparently originated and are most common in the north temperate zone, but in the tropics they are largely replaced by woody plants.

HERBARIUM, a collection of dried, pressed and usually mounted plant specimens kept for study and reference. Such collections are mounted on standard sized sheets of stiff paper (11½x16½ in. in America), poisoned or fumigated to prevent insect attack, and filed according to different needs. As most herbaria are formed for the study of systematic botany, the specimens are arranged by species, genera and families. They serve as the basis of all descriptive floras, contain the type specimens upon which a new species has been founded, and are in indispensable adjunct of all work in systematic botany. Some of the older herbaria in Europe contain most of the specimens collected during the early exploration of America, so that hundreds of the original specimens of the North American flora are preserved at Kew Gardens, England, and in Paris. In America the most important collections are the U.S. National Herbarium at Washington, D.C., the Gray Herbarium at Cambridge, Mass., the New York Botanical Garden and the Missouri Botanical Garden. N. T.

HERBART, JOHANN FRIEDRICH (1776-1841), German educator and philosopher, was born at Oldenburg, Germany, May 4, 1776. At the University of Jena, 1794-98, he studied under Fichte and for a time accepted his teachings. Later, however, he broke away from these and formulated his own doctrine of philosophy, which embodied Realism as opposed to Idealism. From 1797-1800 he taught the sons of the governor of Interlaken and during this time met JOHANN PESTALOZZI and visited his school at Burgdorf. In 1802 he taught education and philosophy at the University of Göttingen. Here he became well known through his extensive writings and was invited in 1809 to succeed Krug, who had followed Kant, as professor of philosophy and pedagogy at Konigsberg. In 1810 he founded a pedagogical seminary, which he directed until 1833. He then returned to Göttingen to lecture and continue his educational and philosophical writings.

Herbart held that education was a science, quite in a field of its own and not merely a department of philosophy. The aim of education, he believed, was morality. His pedagogical doctrines were introduced in America the latter part of the 19th century by Charles DeGarmo, Charles A. and Frank McMurry and others and within a few years were widely accepted. His doctrine of apperception was particularly favorably received. Herbart died at Göttingen, Germany, Aug. 14, 1841.

See C. de Garmo, *Herbart and the Herbartians,* 1895; J. Adams, *The Herbartian Psychology Applied to Education,* 1897; P. R. Cole, *Herbart and Froebel, an Attempt at Synthesis,* 1907.

HERBERT, GEORGE (1593-1633), English poet, was born Apr. 3, 1593, at Montgomery Castle, Wales. Following graduation from Cambridge he was appointed prelector in the rhetoric school, and public orator. The latter position took him much to court where he was high in favor and formed friendships with many famous men. But Herbert adopted the religious life and was ordained in 1630, receiving the living of Bemerton, Wiltshire. There he lived a model life and wrote his hymns and religious poems which were posthumously published as *The Temple,* and which still have vital interest because of their beauty, serenity and spiritual quality. Like JOHN DONNE, his great contemporary, Herbert was a metaphysical poet, and also like Donne he was a master of a concise, epigrammatic style. The poet died at Bemerton, Mar. 3, 1633.

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HERBERT, VICTOR (1859-1924), Irish music composer, was born at Dublin, Feb. 1, 1859. He was a grandson of the Irish novelist, Samuel Lover. Beginning his career as a cellist, he came to the United States in 1886 and played in the orchestra of the Metropolitan Opera, New York, later becoming assistant conductor under Anton Seidl and THEODORE THOMAS. During 1894-98 he was bandmaster of the New York 22nd Regiment, after which he conducted the Pittsburg Symphony Orchestra. Meanwhile he had begun to compose light opera, beginning with *Prince Ananias,* produced in 1894, the first of his series of remarkable successes, the greatest of which were *Babes in Toyland, The Red Mill, Little Nemo, Naughty Marietta, The Madcap Duchess,* and *Princess Pat.* He also composed music for the screen, two concertos for violoncello, an Irish rhapsody, and shorter pieces, and two grand operas, *Natoma,* produced in 1911, and *Madeleine,* presented in 1913. He died at New York, May 26, 1924.

HERB ROBERT (*Geranium Robertianum*), a biennial, heavy-scented herb of the geranium family,

widely distributed in north temperate regions. In North America it is found from Nova Scotia to Manitoba and southward to Pennsylvania and Missouri. It grows about a foot high, with weak, extensively branching stems, bearing thin, much divided leaves and red-purple flowers, ½ in. broad, on slender two-flowered stalks.

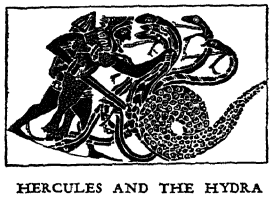
HERCULANEUM, an historic city of Campania, situated between Neapolis and Pompeii, at the foot of Vesuvius, probably founded by Oscans. It became a Roman possession during the Samnite Wars, but revolted in the Social War. In 88 B.C. it was again taken by Rome. It was damaged by earthquake in 63 A.D. and in 79 A.D. was buried beneath a blanket of tufa and ashes by the eruption of Vesuvius which destroyed Pompeii. The 18th and 19th century excavations, accomplished by tunneling beneath the modern town of Resina, have revealed the priceless art treasures of Herculaneum. A theater, forum, basilica and many other buildings have been found. In the theater, capable of seating about 10,000 persons, were statues of the Balbus family, Nero and Germanicus, and fine mural paintings. Among other paintings were pictures of Theseus, who slew the Minotaur, and Chiron instructing Achilles on the lyre. In the Villa Suburbana were marbles and black bronzes, among these were the reposing Hermes, the discoboli and the Sleeping Faunus. In this villa, too, was the famous library of about 1,800 papyri, mostly in Greek, containing works of Epicurus, Philodemus and others. All the discoveries show the inhabitants to have been people of great culture.

HERCULES, in classical mythology, the most celebrated of all heroes, son of ZEUS and Alcmene of Thebes in Boeotia, was unusually strong from his



HERCULES AND THE NEMEAN LION

birth. Hera (*see* JUNO), jealous of Alcmene, laid pitfalls for her offspring, but with the help of Zeus and ATHENA he escaped them. Hercules married the daughter of the king of Thebes, but in a fit of madness killed her and their children. The oracle at Delphi told him he must serve Eurystheus for 12 years to expiate the crime. During this time he performed his "Twelve Labors" which were: to strangle the Nemean lion, fight the Lernean hydra, capture the Arcadian stag, hunt the Erymanthian boar, cleanse the stables of Augeas, King of Elis, destroy the Stymphalian birds, capture the Cretan bull, subdue the mares of the Thracian DIOMED, seize the girdle of the queen of the Amazons, capture the oxen of GERYON in Erythia, fetch the golden apples of the Hesperides and bring CERBERUS from the lower world. Returning to Thebes, Hercules wished to marry Iole, daughter of Eurytus, but having in another fit of madness killed her brother, the oracle told him he must work for hire three years and give the wages to Eurytus. To do this Hercules served the queen of Lydia, thence sailing to Troy and later to Calydon. Here he married



HERCULES AND THE HYDRA OF LERNA
From a Greek amphora



HERCULES AND CERBERUS
From a Greek amphora

Deianira, but deserted her for Iole. Deianira tried to recapture his love by sending him a shirt dipped in the blood of the centaur NESSUS, whom Hercules had shot with his arrow. The blood, being poisoned from the arrow, caused Hercules great agony, so that, climbing onto a funeral pyre, he caused it to be set on fire. A cloud came down from heaven and carried the hero to Olympus, where he was deified and married HEBE.

HERCULES (gen. *Herculis*), a large constellation in the northern sky, standing high in the south during early evening in July and August. It was named after the half-god of Greek mythology. One of the interesting double stars in this constellation is Zeta Herculis. Its distance is 30 light years. Of two components, one is 16 times brighter, the other 16 times fainter than the sun. They revolve about each other in 34 years at a distance of 110 million miles. Mu Herculis is a triple star whose faintest two components move jointly around the brighter star. They also revolve around each other in 43 years. They are some 100 million miles apart. Each of them is 200 to 250 times fainter than the sun. *See* STAR: *map.*

HERCULES-CLUB, a name given to the North American ANGELICA-TREE (*Aralia spinosa*), a spiny shrub closely allied botanically to the spikenard and ginseng.

HERD, a group of animals, usually large ones, which feed, move and seek shelter together either for mutual protection or, as with domestic animals, under the care of man. The term is generally applied to cattle, but may also be used of horses, pigs, camels, elephants or whales, and sometimes of large birds, as

swans or cranes. For wild animals, the herd formation gives to the individual the strength of the mass, the herd instinct to protect the young and the females accounting for the continued existence of many animals constantly preyed upon by wolves and other predatory meat-eaters. When forage is scarce, however, herding often leads to disease or starvation. The herd leader is usually a mature male of great strength and cunning. A herdbook is the owner's record of pedigrees and other facts relating to cattle.

HERDER, JOHANN GOTTFRIED VON (1744-1803), German philosopher and historian of literature, was born at Mohrungen, East Prussia, Aug. 25, 1744. He studied theology at Königsberg university and went to Riga as teacher and preacher. Herder was much influenced by his philosophical contemporaries, Rousseau, Hume and Kant. His significance as a precursor of romanticism is best studied in his following works:

Fragments on Recent German Literature, 1767-68, is a commentary on contemporary literature containing minute analysis as to the significance of language and literature on national life, and the impossibility of transplanting foreign cultures such as Hebrew or Greek on German cultural soil. In poetry, Herder insists, a nation finds its soul.

Critical Forests, 1769, embodies a criticism of G. E. Lessing's *Laokoon* and emphasizes the greater importance of vital energy in a poetical work than description and sentiment. On this doctrine the new generation built the school of *Kraftgenies* or "Genius of energy."

In 1770, Herder moved to Strassburg and met Goethe. There he produced *Letters on Ossian* and *Songs of Ancient Peoples,* 1773, in which a fictitious Celtic bard is enthusiastically received as heralding a new gospel in literature. In the *Essay on Shakespeare* Herder expresses his enthusiasm over Shakespeare as a true representative of his age.

The collection of poems, *Voices of the Nations in Songs,* 1778, ranges from Kamchatka to Peru in its translations; its wild folksongs exerted a unique fascination for the age. Herder died at Weimar, Dec. 18, 1803.

HEREDIA, JOSÉ MARIA (1803-39), Spanish-American poet, was born in Cuba in 1803. Part of his early years was spent in Santo Domingo; from 1812 to 1817 he lived in Caracas, capital of Venezuela; there followed, in 1820, a period in Mexico City, during which he studied law at the University, completing his course in 1821 at the University of Havana. Fleeing from the accusation of conspiracy against the Spanish Government, he came to the United States in 1823, living here for 2 years, chiefly in Boston and New York. In 1825 he revisited Mexico, in which he was destined to live longer than in his native island. Here he was appointed to a number of important positions in the political, educational and juridical life. Heredia's fame as a poet rests on a few compositions, notably *Niagara, El teocalli de Cholula* (*The Temple-Pyramid of Cholula*), *En una tempestad* (*In a Tempest*) and *Al sol* (*To the Sun*). As a playwright he was unsuccessful. Heredia was in personality and period transitional between pre-romanticism and the Romantic School. He is at his best in his apostrophes to Nature. Heredia died in 1839. I. G.

HEREDIA, JOSÉ MARIA DE (1842-1905), French poet, was born near Santiago de Cuba, Nov. 22, 1842, of mixed Spanish Creole and French parentage. He was educated in France and early in life decided to devote himself to literature. With other young poets, some of whom later became celebrated, he joined a group known as the "Parnassians," whose object it was to emphasize the supreme importance of form, as opposed to personal emotion, in poetry. Heredia's own verses are the faithful expressions of this doctrine. He is particularly celebrated for his sonnets, most of which appear in *Les Trophées,* published in 1893. Heredia was elected to the French Academy in 1894. He died at Bourdonné, Oct. 3, 1905.

HEREDITY, a word having many definitions but best scientifically defined as the internal control of development. The phenomenon of resemblance between parents and offspring results from the similarity of the specific internal factors which have controlled development in the case of a child and his parents. The mechanism of the internal control of development is now recognized to be a large number of molecules or possibly molecule-groups that are found in the nucleus of living cells of the body; and each of which plays a specific rôle in development. The direction of development of the child is brought about by the sum of the activity of these various genes in the egg cell and the sperm cell. Certain of these genes may occur in all of the ova of the mother and in all of the sperm cells of the father and they may be alike in the germ cells of the two parents; but so numerous are the genes, numbering several thousand, and so diverse is the ancestry of any human being that certain of the genes are modified or absent in some of the eggs of the mother and similarly different in some of the sperm cells of the father and therefore very different in the combination that comes to direct the development of the child. The corresponding genes, whether identical or dissimilar, of the sperm and the egg come to lie in close association in the fertilized egg, the so-called zygote. The genes are not scattered in the central body of the cell called the nucleus but are in definite associations. Several hundred genes, usually the same ones, are bound in a single thread of the nucleus. Under certain circumstances this tenuous thread becomes constricted into a sausage-shaped body that deeply attracts various dyes and is called a chromosome. The number of these associations, or chromosomes, found in the ripe egg cell of the human is 24 and the same number is found in the sperm cell. In the zygote there are 48 chromosomes which, under certain circumstances, are associated in pairs, one element of which is of paternal and the other of maternal origin.

The different genes associated in a single chromosome not only tend to keep together, but every separate gene has a particular rôle to play in the mechanism of the cell in development of organs which are formed as a result of the life processes of the developing cell. Some of these genes play a part in determining the general form of the body; others play a comparatively restricted rôle, chiefly in influencing the development of a single organ, as for example, the pigmentation on the iris.

As before stated the corresponding genes may be alike or dissimilar. If alike, they both work the same way toward the production of a trait of the adult. If one of a pair of genes, say from the mother, is vigorous and the corresponding one from the father is relatively weak or inactive, then the character that depends upon the more active gene will be well developed in the child and the character which depends upon the less active will be poorly developed. The more active gene is spoken of as the dominant one, thus, for example, a gene which produces only brown pigment in the iris. In common parlance, brown eye color dominates over blue. If, in given parents, the activity is weak, then the combination is weak and in the children the trait will develop weakly or not at all. Thus if the gene for brown pigment in the iris is inactive in the father and the mother, then it will be also inactive in the development of the children and the iris of the children will have little brown pigment or perhaps a pure blue eye. In these cases there fails to appear in the body the dominant condition of the trait. The opposite condition, called the recessive, if found in both parents, is the one that is now brought to view in the offspring.

This is the essence of Mendelism, according to which a stronger trait tends to dominate over a weaker one; or its presence over its absence.

Where the corresponding genes of the two parents are unlike the offspring that arise are said to be in respect to the corresponding trait dissimilarly yoked—heterozygous. Heterozygous parents all produce germ cells with the fully developed or with the imperfect form. If two parents heterozygous for the same trait are mated, each having the two kinds of germ cells, then the offspring either receive two dominant genes or two recessive genes, or one dominant and one recessive gene and these three conditions are realized in the proportions of 1 : 1 : 2. That is, there segregates in the children one dominant, one recessive and two heterozygous again. This is the simplest form of Mendelism. If there are two dissimilar genes or more in the two parents, whether producing the same trait or different traits, the proportion of children of each type is a complicated one.

The number of human traits whose inheritance has been satisfactorily studied is not very great. A table with dominance and recessiveness, to be accepted only with great caution, is given by Laughlin in his book *Biological Sterilization,* also in textbooks like Gates' *Heredity in Man,* 1929. Some defects, like most of those relating to the hand, are dominant; others like those responsible for full mental development are recessive. A number of genes for traits are located in the so-called sex chromosome which is active in the female but not in the male. These have a curious, criss-cross inheritance. To this type belong color blindness, hemophilia, atrophy of the optic nerve and some other less well-known conditions. The foregoing three are recessive and do not show in females which get the normal sex chromosome from one parent but do show in the males when their mothers are heterozygous for the trait.

The genes develop in the midst of the environment afforded by the embryo and by the world outside of the embryo, and the course of their development may be modified by a greater or less extent by the nature of the environmental conditions. Unless the environment is favorable within fairly narrow limits, the gene, the embryo as a whole, may fail to develop. Contrary to earlier opinions, all recent experimental work indicates that the genes are not modifiable by the ordinary environment in a way that fits them for the environment. On the other hand, the genes are, from time to time, undergoing spontaneous change, chiefly in the nature of a breaking-up. This process is called mutation. A modified gene produces a modified organ. Mutation may, in some cases, be accelerated by a high temperature or by high frequency vibrations, as of X-rays or radium.

Mutations are of various kinds. Generally they are fatal to the developing organism or do not render it fitted for its environment. If, however, the mutation is especially favorable and if it has a segregated area to develop in it may come to be widespread over a greater or less population. All those characterized by the new mutation constitute a race. Where a mutation affects all of the individuals over a large area it constitutes a major race, like the black-skinned, broad-nosed, woolly-haired negroes of Africa or the short-legged, yellow-skinned, straight-haired orientals of eastern Asia or the blue-eyed, blond-haired tall Nordics of northern Europe. At the periphery of the area of the race, where contacts are made with other races, hybrids occur and the character of a distinct race is lost through mixture of dissimilar genes in the population.

C. B. D.

HEREFORD, a city and the capital of the county of Hereford, southwestern England. It is situated on the left bank of the River Wye; London lies about 144 mi. to the southeast. During the Middle Ages the traffic in wool was significant because it fostered the development of guilds. At present agriculture plays the biggest rôle in the trade of Hereford. There is an endowed grammar school, public library and museum; many of the public utilities are owned by the town. Hereford's most notable edifice is the cathedral, constructed between 1079 and 1535, which exhibits every architectural style cognizant during that period. David Garrick, the actor, was born in Hereford. Pop. 1921, 23,322; 1931, 24,159.

HERESY (from the Greek *hairesis,* meaning choice or selection), in its general sense, is applied to a view

or opinion held contrary to the prevalent standard. In theology, it is the name given to a religious opinion, maintained within the Church, that is opposed to the orthodox doctrinal standards of the Church.

Even in Apostolic times, wide divergences of opinion existed within the Christian Church, making it necessary to formulate doctrine for the sake of maintaining unity. Those who willfully departed from the accepted dogmas came to be styled heretics. A large proportion of the early heresies, such as Gnosticism, Manicheism and Marcionism, grew out of attempts to unite Christian dogma with Oriental mysticism and Greek speculation. The two most serious heresies of the early Church, ARIANISM and Nestorianism (*see* NESTORIANS), had to do with doctrines concerning Christ.

The early Church looked upon heresy as a most serious offense; after Constantine's championship of the Church the latter was provided with a powerful civil arm, and the punishment for heresy became increasingly severe. By the time of Theodosius II (382) it was a capital crime. The Code of Justinian provided various civil penalties for heresy, ranging from infamy, exile and confiscation of property, to death. The Church waged a relentless war against the Albigenses of southern France early in the 13th century which resulted in the massacre of tens of thousands of heretics. Following the Protestant Revolt, several Protestant bodies imposed the death penalty on heretics. The attitude toward the offense has been considerably modified in modern times. The Roman Catholic Church distinguishes "formal" heresy, that is, pertinacious adherence, by a baptized person, of views contradictory to the tenets of the Church, from "material" heresy, where the heresy is maintained through ignorance. Heresy differs from schism and apostasy, being considered more serious than either.

HERFORD, city in the Prussian province of Westphalia, located at the junction of the Aa and Werra rivers, about 50 mi. southwest of Hanover. It is primarily occupied in the manufacture of textiles and machinery. It has grown about a nunnery which was founded in the 9th century. The abbess was a princess of the empire and ruler of Herford until 1547. The Romanesque minster was built early in the 13th century and the Gothic abbey Church of Our Lady in 1325, replacing the earlier one of 1030. Pop. 1925, 35,887.

HERGESHEIMER, JOSEPH (1880-), American novelist, was born in Philadelphia, Pa., Feb. 15, 1880. He was educated at a Quaker school there, and studied at the Pennsylvania Academy of Fine Arts. He determined to become a writer, and wrote for several years before finding a publisher. Perhaps his best known novels are *The Three Black Pennys,* 1917, *Java Head,* 1919, *Cytherea,* 1922, *The Party Dress,* 1929, and *The Limestone Tree,* 1931. Hergesheimer is also the author of *Sheridan,* 1931, a biography.

HERISAU, a market town of Switzerland, capital of the canton of Appenzell-Ausser-Rhoden. It has an old and a new church, a town hall, which is also the cantonal building, and two banks. Next to St. Gall it is the most important center of machine embroidery and weaving, and there are also dyeing and bleaching plants, and a cable factory. Pop. 1930, 13,601.

HERKIMER, NICHOLAS (c. 1728-77), American soldier, was born near Ft. Herkimer, N.Y., about 1728. Commissioned lieutenant of militia in 1758, he gained experience in the French and Indian wars, and in 1776 became brigadier-general of the militia of Tryon Co. In 1777 he marched to the relief of Fort Stanwix, besieged by a combined force of British regulars, New York loyalists and Brant's Indians under General St. Leger. Ambushed at Oriskany, the militia after a prolonged battle defeated the British, who retreated into Canada. Herkimer, whose leg was mangled during the fight, sat under a tree and "issued orders while smoking a pipe." He died in Danube, N.Y., on Aug. 17, 1777.

HERKIMER, a village in eastern New York, the county seat of Herkimer Co., situated on the Mohawk River, 15 mi. southeast of Utica. River craft and the New York Central Railroad afford transportation. Herkimer has a brisk trade in dairy products, but the leading industry is the manufacture of desks and other office furniture and gloves. The manufactured output, 1929, was valued at $5,050,617. The retail business in 1929 amounted to $7,284,155. Herkimer was founded by German settlers on a tract of land purchased from the Mohawk Indians about 1725. It was later named for the Revolutionary General, Nicholas Herkimer. Pop. 1920, 10,453; 1930, 10,446.

HERMANNSTADT. *See* SIBIU.

HERMAS, SHEPHERD OF, an early Christian writing included among those of the Apostolic Fathers. Its author is unknown, although he refers to St. Clement as a contemporary. Hermas has been identified with the person of that name mentioned in the Epistle to the Romans, 16:14. The book consists of five visions, in the last of which a man appears as a shepherd who gives Hermas 12 mandates or commandments and 10 parables. It is ethical rather than theological in its teaching, being concerned with the Christian virtues and their exercise. The scene of the visions is laid in the vicinity of Rome. Some scholars date the book at about 100 A.D., others at 50 years later. In early times, according to Eusebius, it was much enjoyed and was read like the Scriptures in the churches, although it was not afterwards included in the canon.



TRIPTOLEMUS AND HERMES

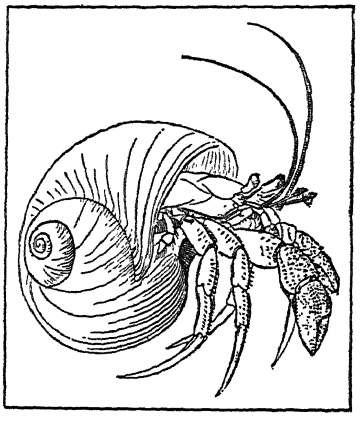
HERMES, in Greek mythology, the messenger of the gods, identified with the Roman MERCURY. He frequently guided the dead to Hades.

HERMIONE, in Greek mythology, daughter of MENELAUS and Helen (*see* HELEN OF TROY), was

given by her father in marriage to PYRRHUS, son of ACHILLES, in spite of the fact that she had been promised to ORESTES. Pyrrhus was killed by Orestes and then Hermione married him.

HERMIT CRAB, the popular name for crabs of three families, the common hermit crabs (*Paguridae*), the deep sea hermit crabs (*Parapaguridae*) and the land-living hermit crabs (*Cenobitidae*). All hermit crabs are lacking in abdominal armor, and nearly all have some sort of house to shield their soft bodies.

The common hermit crab lives in the deserted shells of dead sea snails. Its body is twisted to fit the shell,



HERMIT CRAB (*Eupagurus bernhardus*) IN SHELL OF A SNAIL (*Lunatia heros*)

and its tail appendages are modified to hold tightly to the spire of the shell. The hermit does not leave one shell except to move to a larger one. He carries it about with the greatest ease, walking with his legs protruding from the door. One of his pincer claws is larger than the other. When frightened he withdraws completely into his house, blocking the entrance with his big claw. Two species are common on the Atlantic coast of North America, the small *Eupagurus longicarpus,* usually found in dog-whelk shells, and *Eupagurus pollicaris,* which uses Lunatia, conch and wrinkle shells.

Some of the land-living hermit crabs are fairly large. Two of these are the Diogenes crab (*Cenobita diogenes*) which lives in coconut shells, and the robber crab (*Birgus latro*) which, being over a foot long and very active and powerful does not bother with any shell at all. *See also* CRAB.

HERMITS, or eremites, sometimes called anchorites, as their name implies, persons who retire to a life of solitude, especially from religious motives. In the earliest days the solitude was commonly sought in deserts and forests. Elijah in the Old Testament and John the Baptist in the New Testament provide the best-known Biblical examples. In addition to the so-called religious motive of escape from the world, Christian and non-Christian hermits have been moved by the desire for meditation, prayer, study, escape from persecution and even by the acquisition of repute as ascetics. St. Anthony was the first Christian hermit of note, although he followed the example of others who fled to the deserts of Egypt. They became common in Palestine, Egypt, Mesopotamia, Arabia, Syria and Asia Minor, and adopted various austerities. The stylites lived for years on the tops of pillars, the recluses locked themselves in cells, the stationaries stood erect and still in one place, and all practiced asceticism. The retreats of Protestant and Catholic churches seek to meet in part the need for such retirement in modern days, and the practice is common in many non-Christian religions.

HERMON, a mountain of Syria, the highest elevation of the Anti-Libanus chain, of which it is the southern extremity. Hermon is the most picturesque mountain of Syria and its beauty has been an inspiration in Hebrew and Syrian literature. It can be seen from great distances, its summit, which is covered with snow the greater part of the year, rising nearly 10,000 ft. high. On the lower slopes of the mountain are many glens and ravines which are covered with vegetation, particularly fruit trees.

HERMOPOLIS, also Hermoupolis, a town in Greece, capital of the island of Syra, or Syros, and seat of the nomarchy of the CYCLADES. Picturesquely situated on the eastern shore of the island, it is an important commercial center, celebrated especially for the excellent candy known as lokoum which is manufactured here and exported throughout the world by Greek merchants. The length of the island of Syra is about 10 mi., its greatest breadth 5 mi., and its area 42 sq. mi. Pop. 1928, 21,156; the population has shown a gradual decrease because of the competition of Salonika.

HERMOSA BEACH, a residential city on the southwestern coast of California, in Los Angeles Co., 20 mi. southwest of Los Angeles; served by buses, the Pacific Electric Railway, and the Santa Fe Railroad. Flowers, flower seeds and truck crops are raised in the vicinity. Tiles and silk are manufactured. The city has two mi. of sandy beach with exceptional bathing and deep-sea fishing facilities. Hermosa Beach was founded and incorporated in 1907. Pop. 1920, 2,327; 1930, 4,796.

HERNANI, a tragedy in verse by VICTOR HUGO, produced 1830. This drama of a 16th century Spanish nobleman who kills himself from a lofty sense of honor, strained and unreal in situation, often mawkish and grandiloquent, is yet a monument in the history of the French theater, for it was this play more than any other which ended the reign of CLASSICISM and opened the way to 19th century ROMANTICISM. Verdi's opera ERNANI was adapted from the play and produced in 1844.

HERNE, JAMES A. (1840-1901), American actor and playwright, was born at Cohoes, N.Y., Feb. 1, 1839. At 20 he joined a company in Troy to play George Shelby in *Uncle Tom's Cabin.* He then went to Baltimore, Washington and to California. While acting as stage manager he began to write plays, adapting Dickens and Lever. His first play produced

was *Hearts of Oak,* 1879. His best known was *Shore Acres,* produced at McVicker's Theater, Chicago, 1892, in which he played his famous rôle of Uncle Nat Berry. More serious plays from his pen were *Margaret Fleming* and *Griffith Davenport.* He died June 2, 1901.

HERNE, a German city in the province, of Westphalia; a north suburb of Bochum, lying in the Ruhr valley on the Rhine-Herne and Dortmund-Ems canals. It is an industrial city and has a large works for the production of nitrogen, and has machine, boiler and stove factories. Situated as it is, it serves as the turnover port for goods shipped on the inland waterways. Pop. 1925, 91,297.

HERNIA, a protrusion of an internal organ, or part of an organ, through an abnormal opening or weak spot in the wall of the cavity in which it lies. It is covered by the membrane lining of the cavity, which is known as the sac. More commonly the term is used to denote protrusion of one or more intra-abdominal organs through the abdominal wall. This most commonly occurs through one of the natural openings, as the inguinal ring (inguinal hernia), or femoral ring (femoral hernia), when these rings have remained abnormally large in development, or have become stretched as a result of increase in intra-abdominal pressure, through heavy lifting, or chronic coughing. The same causes are responsible for protrusion through weak spots in the abdominal wall, as at the umbilicus (umbilical hernia), or through the scars of old operative incisions (incisional hernia). Hernia may occur, also, through the diaphragm (diaphragmatic hernia).

In describing a hernia one speaks of (*a*) the *contents,* the organ, part of an organ, or organs protruding; (*b*) the *sac,* which contains them and consists of peritoneum, the membrane lining the abdominal cavity; and (*c*) the *coverings,* which consist of all the structures which normally overlie the hernial orifice, as muscles, fascia, fat and skin.

The contents consist most commonly of the omentum (fatty apron), or a loop of small bowel; more rarely large bowel or the bladder, and rarely almost any other organ in the abdomen except the pancreas. A hernia containing omentum only, is called an *epiplocele;* one containing bowel is called an *enterocele.*

The opening through which the hernia protrudes is known as the *hernial ring.* The portion of the sac at the ring is usually the narrowest portion of the sac and is called the *neck of the sac.* The sac is often more or less pear-shaped, the portion furthest from the hernial ring being the largest. This is known as the *fundus of the sac.*

A hernia may be *congenital* or *acquired.* In inguinal hernia, the commonest type, the sac or protrusion of peritoneum is present from birth in the groin as a defect in development. Later in life, the contents are forced into this pre-existing sac as a result of some sudden over-exertion or repeated straining. Most inguinal hernias are congenital.

Men suffer from hernia more frequently than women because of their heavier work and because the inguinal ring is normally larger in the male than in the female.

A hernia is said to be *reducible* if the contents spontaneously return into the abdomen when the person lies down (spontaneous reduction), or can be returned into the abdomen by pressure of the hand on the sac (taxis). Taxis or reduction is accomplished by having the person lie down with head low, feet raised, and thighs flexed. With one hand the neck of the sac is held fixed, while the other hand grasps the sac from below, with the fundus of the sac in the palm of the hand and the fingers exerting a steady pressure upon the contents, gently pressing the contents back into the abdomen, returning first the portion that escaped last, that is, the part nearest the ring.

A reducible hernia usually appears as a more or less soft, rounded prominence. The commonest form is the inguinal hernia, which may appear at one time but be absent at another, and may vary in size at different times, usually becoming larger when the person strains or coughs, felt as an *impulse on coughing.*

When the contents cannot be returned into the abdomen, the hernia is said to be *irreducible.* A hernia, originally reducible, may later become irreducible because of its large size, compared with the size of the ring, inflammation of the peritoneal sac and the contents (inflamed hernia) with resultant induration, or due to adhesions between the sac and the contents or between the contents themselves. Irreducibility presents a constant source of danger, due to the tendency to constant increase in size, injury, and chiefly the liability to strangulation, or constriction of the contents to such a degree as to stop the circulation of the blood (strangulated hernia). This, if not promptly relieved, eventually leads to death of the contents, with fatal outcome.

The larger the hernial ring, the greater is the probability that the hernia will remain reducible. The smaller the ring, the greater is the probability that it will become irreducible, and the greater is the danger of strangulation.

The *symptoms* of hernia, in addition to the swelling described above, are a sensation of weakness at this point, a dragging sensation, and less often, a colicky pain, now and then, these being more noticeable when exercising or doing heavy work.

In irreducible hernia these symptoms are likely to be more marked, especially the colicky pain. In addition, signs and symptoms of inflammation are more apt to develop, as local heat, redness, tenderness and fever.

In strangulated hernia the symptoms are the same as in irreducible hernia, but in addition, shock characterized by weak rapid pulse and subnormal temperature, pain referred to the umbilicus as well as over the region of the hernia, vomiting, early of food, later of bile, and very late even of feces; con-

stipation, absolute from the first in most cases; and later toxemia with anxious expression, shrunken face, sunken eyes, fever, and even delirium and coma. Finally, if not properly treated and relieved, peritonitis and death.

The *treatment* of a reducible hernia consists of either the reduction and application of a truss, or radical operation, though there is no doubt that in nearly all cases operation is the most satisfactory treatment. In infants, reduction followed by application of a properly fitting truss may effect a cure in about one year. In older children, and even in infants (if the ring is large or if reduction is difficult), and in adults, operation is the best method of treatment, unless contraindicated by some constitutional condition such as severe heart disease, advanced kidney disease, and feebleness in very old individuals. Irreducible hernia should be operated upon as there is always the danger of strangulation.

Radical operation consists in exposing the sac, opening it, returning the contents into the abdomen, and cutting away the sac at the neck and closing this by suture flush with the peritoneum of the abdominal wall. This is perhaps the most important part of the operation. Next, the hernial ring is closed by suturing the weak spot, or by closing the abnormally large natural opening to a normal size.

In strangulated hernia the constriction is relieved and then the contents reduced and the operation completed as outlined above, unless the contents are so damaged that they are no longer viable. In this case the dead contents are cut away. If the bowel is dead, the dead portion is excised and the two opened ends sewed together and then the operation completed as above. D. C. S.

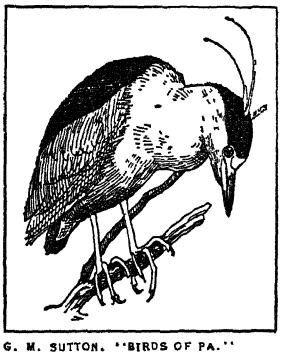
HERO, in Greek mythology, a priestess of APHRODITE at Sestos, in Thrace, on the Hellespont. Her lover Leander lived at Abydos, on the opposite shore of the straits. Nightly guided by a lamp he swam the water to visit his love, but one night in a storm he was drowned. Hero in anguish threw herself from her tower and died with him.

HEROD, THE GREAT (c. 73-4 B.C.), King of Judaea from 37 to 4 B.C. His father Antipater was appointed procurator of Judaea by Julius Caesar, 47 B.C. As governor of Galilee at the age of 25 Herod displayed energy and independence. In 43 B.C., when Antipater was assassinated, Judaea was thrown into turmoil. The Parthians taking advantage of this sent an army against Jerusalem, 40 B.C. Mark Antony seeing in Herod, who had fled to Rome, a potential ally against Parthia persuaded the senate to declare him king of Judaea. Returning to Palestine in 39 B.C., Herod took Jerusalem, 37 B.C., and put to death Antigonus, who had usurped the throne. Herod established his power by the ruthless extirpation of his enemies. He took no active part in the struggle in 31 B.C. between Antony and Octavian, although favoring Antony. Octavian, however, confirmed his position. Herod ruled well, suppressing brigandage and fortifying his frontiers. He restored the temple at Jerusalem, founded cities, and established games in honor of Augustus.

HERODOTUS (c. 484-424 B.C.), Greek historian, was born at Halicarnassus in Asia Minor. After extensive travels in Asia Minor, Babylonia, Phoenicia, Egypt, Scythia, Thrace, the Aegean islands, Greece and Magna Graecia, in the course of which he carefully observed the customs and learned the traditions of the people, he settled at Thurii, c. 443 B.C., an Athenian colony in southern Italy. With this background, enriched by wide reading, he was superbly equipped for his work as an historian. He chose as his subject the struggle between the Greeks and Persians culminating in the successful resistance made by the Greeks to the great Persian invasions in 490 and 480 B.C. The first six books of his history form a comprehensive introduction to this theme, acquainting the reader with the past history of the contending peoples, and in charming digressions diverting him with miscellaneous information about strange lands and customs. Herodotus in the last three books gives a thrilling account of the perils of Greece and of her triumph over the Persian hosts. Apparently credulous as a child, frequent flashes of humor suggest that Herodotus could distinguish between the true and the fanciful. Herodotus has a simplicity and ease unsurpassed by subsequent historians. G. M. H.

HEROIC VERSE, in English, the iambic pentameter or heroic couplet; in ancient Greek and Latin, the hexameter; and in French, the ALEXANDRINE. The heroic couplet, invented by CHAUCER in his *Legend of Good Women,* 14th century, has been used by many poets: by the Elizabethans, chiefly in their prologues and epilogues; very notably by POPE and DRYDEN, and by Alfred Noyes in his *Drake,* 1908. *See also* POETRY.

HEROIN, a trade name for di-acetylmorphine, $C_{17}H_{17}(O{\cdot}OC{\cdot}CH_3)_2NO$. It is a white bitterish crystalline powder and is generally used in the form of hydrochloride. It is both anodyne and a sedative and has been used in treatment of irritative coughs. The danger of habituation to di-acetylmorphine, however, is even greater than habituation to morphine. Prescriptions for di-acetylmorphine must conform to provisions of the Harrison Narcotic Law. The importation of this substance into United States has been forbidden by law.



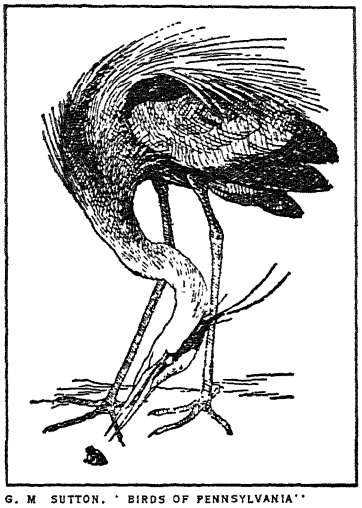
G. M. SUTTON, "BIRDS OF PA." J. HORACE MCFARLAND CO. COPYRIGHT

BLACK-CROWNED NIGHT HERON
Nycticorax nycticorax hoatli

HERON, one of the family (*Ardeidæ*) of large wading birds somewhat resembling the cranes. There are over 200 species of herons, frequenting swamps, marshes and occasionally seacoasts almost throughout the world, though most numerous in warm regions.

They measure from about 2 ft. to 5 ft. in length, and have thin bodies, very long legs, a long neck and bill, and soft loose plumage. Herons are voracious eaters, feeding chiefly upon frogs, fish and small reptiles. They are often gregarious, living in communities (heronries) and building bulky nests of sticks, usually in trees, in which they lay 3 to 6 bluish-green eggs.

The best known North American species is the great blue heron (*A. herodias*), found from subarctic



G. M SUTTON, " BIRDS OF PENNSYLVANIA"
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GREAT BLUE HERON

regions to South America. It is a handsome bird about 4 ft. long, bluish gray above and blackish broadly striped with white below. The similar but larger Ward's heron (*A. h. wardi*) occurs along the Gulf coast. The great white heron (*A. occidentalis*), with pure white plumage and ornamental plumes on the neck, is found in Florida and the West Indies.

The name heron is applied also to various other members of the same family (*Ardeidæ*), as the little blue heron (*Florida cærulea*) and the little green heron (*Butorides virescens*), both found in North America. *See also* BITTERN; BOATBILL; AGAMI; EGRET. A. B. J.

HERONDAS or **HERODAS** (3rd century B.C.), Greek poet of the Alexandrian school, was born probably at Cos. He wrote mimes in the Ionic dialect. Many of them were only 100 lines long, but all were vivid and amusing if somewhat vulgar. They portrayed scenes of ordinary life, such as in a law court or school room. He wrote in the scazon or "lame" iambic which has a spondee at the end. This was very effective in the colloquial conversations which he depicted. *See also* ALEXANDRIAN SCHOOL.

HERO OF ALEXANDRIA (c. 160), Greek mathematician and scientist appears to have lived in the latter half of the 2nd century A.D. The earlier belief that he lived about 100 B.C. seems to be erroneous. Hero compiled a thorough treatise on contemporary mathematics, and added thereto a method of approximating square roots, and some cube roots, where the root is an irrational number. He wrote on surveying, developing an accurate instrument for the purpose and gave a thorough treatment to mechanics, adding many devices apparently invented by himself, including water clocks, steam and water machines. Investigating optical problems he proved that light is reflected at an angle equal to that at which it strikes the reflector. A complete translation in German of all of Hero's surviving works was issued by W. Schmidt and L. Nix in 1899.

HERPES, a term used in various combinations to designate a variety of skin diseases. True herpes is of two varieties; simple herpes and herpes zoster.

Simple herpes is the common cold sore of the lips and also the familiar canker sore of the mouth. The condition is coincident with certain abnormal conditions of the body as colds, digestive disorders, pneumonia and nervous derangements. Their cure depends upon that of the condition which they accompany. A bit of alum has a beneficial astringent action on canker sores.

HERPES ZOSTER, commonly known as shingles, manifests itself by blisters on the skin, resembling groups of cold sores. The sores are usually arranged over a bandlike area, corresponding to the distribution of a nerve in the affected region. They often follow the course of one of the nerves between the ribs, known as an intercostal nerve. There is usually some associated pain.

The condition, which is rather frequent, is practically confined to one side of the body. It is thought to be due to inflammation of the nerves involved. Ordinarily the pain and eruption disappear within a week or two. Occasionally, and particularly in older persons, a painful neuritis may persist indefinitely.

HERRERA Y TORDESILLAS, ANTONIO DE (1559-1625), Spanish historian, named by Philip II historiographer of Castile and the Indies, a position which he continued to occupy during the reigns of Philip III and Philip IV and until his death. His work is important for the abundance of detail given. Though accused of being somewhat partial in his desire to glorify Spain and minimize the accomplishments of her adversaries, his work is considered to be accurate. His *Historia general de los hechos de los Castellanos en las islas y Tierra Firme del mar Oceano* was published in four volumes in Madrid, 1601-15. In addition to this he wrote histories of Mary Stuart, of Portugal, of the world at the time of Philip II of Spain and of France. The manuscripts of these and many others of his works are conserved in Spain and are valuable to historians studying the history of Spain during the reigns of Philip II and Philip III.

HERRESHOFF, NATHANIEL GREENE (1848-), American designer and ship-builder, was born at Bristol, R.I., in 1848. He attended the Bristol public schools, studied technical design and engineering at the Massachusetts Institute of Technology in Boston from 1866-69, and specialized at Brown University in 1896. Beginning his career as a designer and builder of speed craft in the early '70s, he organ-

ized the Herreshoff Manufacturing Co. in 1881, and served as its superintendent until 1915, when he became president. Besides designing and constructing torpedo boats and yachts, he is distinguished as the designer and builder of the following defenders of the America's Cup: the Vigilant, in 1893, the Defender, in 1895, the Columbia, in 1889, the Columbia, in 1901, the Reliance, in 1903, and the Resolute, in 1920. He retired in 1924 and the firm was purchased by Haffenreffer who retained its original name. Herreshoff was elected to the Institute of Naval Architects in England, and to the American Institute of Naval Architects and Marine Engineers.

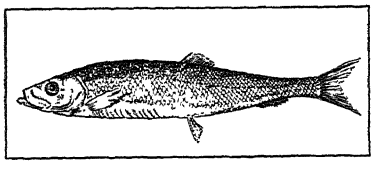
HERRICK, MYRON T. (1854-1929), American diplomat, was born at Huntington, O., Oct. 9, 1854. He attended Oberlin Academy and Ohio Wesleyan University, which he left before graduation. Moving to Cleveland in 1875, he studied law and was admitted to the Ohio bar in 1878, beginning practice in Cleveland. He gave up his law practice in 1886 to become Secretary and Treasurer of the Cleveland Society for Savings, later becoming president. He was elected president of the American Bankers Association, 1901-02. Herrick also was interested in the manufacture of hardware in Cleveland. He was, beginning in 1888, six times a delegate to the Republican National Convention, and frequently a member of the Republican State Executive Committee and of the Republican National Committee. Persuaded to be the Republican candidate for Governor of Ohio, in 1903, he was elected by a record majority, serving from 1903-06. He accepted in 1912 President Taft's appointment of ambassador to France. President Wilson asked him to continue to act as ambassador until a successor should be appointed, which was not done until 1914. Before the successor, W. G. Sharpe, arrived in France, the World War broke out and Herrick in addition to the care of Americans in France was given charge of the affairs of Germany and Austria-Hungary. He organized the American Relief Clearing House in Paris and established the American Ambulance Hospital at Neuilly before he was relieved by his successor, in December, 1914. In 1921 Herrick was reappointed American ambassador to France. He died in Paris, Mar. 31, 1929.

HERRICK, ROBERT (1591-1674), English poet, was born in London, Aug. 1591. At 16 he was apprenticed to his uncle, a wealthy goldsmith, and later attended Cambridge University. Then followed ten years in London as one of the circle of poets, wits and men of letters surrounding BEN JONSON. Appointed vicar of Dean Prior, Devonshire, in 1629, Herrick settled down to work in this secluded country parish, remaining there for almost 20 years. Ejected by the Puritan Parliament, he returned to London and published his celebrated collection of poems, *Hesperides,* but in 1662 Charles II restored him to the vicarage and he spent his remaining years there. Herrick wrote the best of his poems at Dean Prior, describing in lovely lyrics the countryside life, its merrymakings, rural beauty, semi-pagan beliefs and customs. He left 1,300 poems, all short, some no more than two-line fragments, and all marked by great charm and exquisite beauty of expression. He died at Dean Prior in Oct. 1674.

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HERRIN, a city in southern Illinois, in Williamson Co., situated 100 mi. southeast of St. Louis, Mo. Bus lines and three railroads afford transportation. Herrin is in an important coal-producing region. Coal mining is the leading industrial interest, but the city has also machine shops and a powder plant. Agriculture, horticulture and dairying are carried on in the vicinity. Williamson County has been the scene of many industrial disturbances and riots among the miners. The so-called Herrin Massacre took place in 1922, near Marion. Several miles southwest is Giant City State Park, with its enormous rock formations, giving the appearance of a fantastic city. Herrin was incorporated in 1900. Pop. 1920, 10,986; 1930, 9,708.

HERRING, the name given to a numerous family (*Clupeidae*) of soft-rayed fishes, many of which, as the herring, SARDINE, SHAD, ALEWIFE and MENHADEN, are of high economic importance. They have more or less compressed bodies, silvery, smooth-edged



HERRING

scales, large mouths with weak teeth or lacking teeth, and forked tail fins. Most species are wholly marine but several live entirely in fresh water and others, as the shad, leave the sea and ascend rivers at the spawning season.

The common herring (*Clupea harengus*), exceedingly abundant in the North Atlantic, swims in immense schools, sometimes several square miles in extent, feeding chiefly on minute crustaceans. It is bluish above and silvery below, averaging about a foot in length and a pound in weight. This enormously abundant species is one of the most important of the world's food fishes. The largest herring fisheries are those along the coasts of Scandinavia and Great Britain, where some four billion fish are taken annually. There are substantial fisheries on the American coast from Cape Cod to Newfoundland. In 1929, 107,279,000 lbs. of herring, valued at $694,000, were caught in United States waters and 2,263,244 cwt., valued at $1,700,603, were taken on the Canadian coast.

The similar California herring (*C. pallasii*), exceedingly abundant in the North Pacific, is also an excellent food fish. In 1929 the catch along the coasts of the Pacific states and Alaska amounted to 154,979,000 lbs., valued at $1,165,000. Herrings, preserved by smoking, salting, drying, pickling and canning, are extensively used for food throughout the

civilized world. In the eastern United States young herrings are canned and sold as sardines. A. B. J.

HERRING-BONE GEARS. *See* GEARS AND GEARING.

HERRIOT, EDOUARD (1872-), French statesman and writer, was born at Troyes, July 5, 1872. His first important public office was the Mayor of Lyons, following which he was elected senator, and minister of public works in the Briand (*see* BRIAND, ARISTIDE) Cabinet of 1916-17. Resigning from the Senate in 1919 he entered the Chamber of Deputies, where he became leader of the Radical Party. In the general elections of May 1924, he won a decisive victory, and became premier and Minister of Foreign Affairs in the place of RAYMOND POINCARÉ. Not satisfied with this and with the backing of the majority of the deputies he also forced the resignation of President Millerand before the expiration of his constitutional term of office. Herriot remained prime minister till 1925 when he was defeated in the Chamber and resigned. During his term of office he cooperated closely with RAMSAY MACDONALD and the Labor government for the establishment of better relations with Germany. The 1926 financial crisis brought him back to power again but his ministry fell in two days, and he entered Poincaré's Cabinet, from which he later resigned on account of opposition from his party. Like Briand he favors more moderate policy in the enforcement of the peace treaties than do Poincaré and the National Bloc. Herriot became Premier in June 1932, his followers defeating Tardieu. He is the author of *Agir, Fragments d'Écrits Politiques, Creér,* and other books.

HERSCHEL, SIR FREDERICK WILLIAM (1738-1822), English astronomer, born in Hanover, Germany, Nov. 15, 1738, the son of a bandmaster. He was educated as a professional musician, and went over to England in that capacity in 1757, securing positions at Leeds, Halifax and finally at Bath, in 1766. Here he turned his attention to astronomy and, unable to purchase a telescope, made one for himself. With this he discovered the planet Uranus in 1781, and at once achieved international recognition. He was appointed private astronomer to George III in 1782, at a salary of £200 per annum.

Herschel is often called the father of modern astronomy as he was the first who, through his assiduous observations with the powerful telescopes of his own making, was able to grasp something of the vastness of the universe beyond the solar system. In addition to his discovery of Uranus, Herschel was the first to observe actual motion in double stars, and thus able to extend the conception of gravitation from the solar system to the universe at large. His star gauges began to reveal some of the structure of the Milky Way system, while furthermore he discovered two satellites each for Saturn and Uranus, and greatly advanced the knowledge of star clusters and nebulae. One of the greatest observers of all time, Herschel was equally famous for his skill in telescope-making, and during the years 1785-89 constructed a giant instrument with a focal length of 40 feet, a colossal achievement for his age. Herschel received the constant and valuable aid of his sister, Caroline Herschel. One son, John, afterward Sir John Herschel (1792-1871) survived him after his death at Slough, Aug. 25, 1822.

HERSHEY, MILTON SNAVELY (1857-), American manufacturer, was born in Dauphin county, Pa., Sept. 13, 1857. At twenty-one he owned a confectionery shop in Philadelphia and soon afterwards established a candy manufacturing business in New York. Subsequently he engaged in manufacturing chocolate products at Hershey, Pa. In 1910 he established and later endowed the Hershey Industrial School.

HERTFORD, a market town and the capital of the county of Hertford, southeastern England. It is situated on the River Lea; London lies 24 mi. to the south. The town is a distribution center for farm products, and has malting and brewing establishments and glove and brush factories. Hertford has an ancient castle, a few charity schools, a grammar school and a school preparing students for Christ's Hospital. Pop. 1931, 11,376.

HERTFORD HOUSE, a mansion on the north side of Manchester Square, London, famous as the home of the Wallace Collection. Built in 1766-88, it was originally the residence of the Duke of Manchester and was known as Manchester House. Later it became the residence of the Marquis of Hertford, and as such was undoubtedly the original of "Gaunt House" in Thackeray's VANITY FAIR. The celebrated Hertford Collection of paintings and works of art was acquired by the 4th Marquis (1800-70). It was bequeathed to Sir Richard Wallace (1818-90), and was left to the nation by the latter's widow, Lady Wallace, in 1897. The collection, valued at approximately $20,000,000, was opened to the public in 1900.

HERTOGENBOSCHS' or **DEN BOSCH,** capital and chief city of the Dutch province of North Brabant, located on the Dommel, the Aa and the South Willem's Canal, and until 1876 a strong fortress. It is built in the form of a triangle and transected by several canals; has four gates, ten churches, a synagogue, a large armory and barracks. The most noteworthy buildings are the late-Gothic Jans Church, the city hall with a museum collection, the Gothic building of the Swabian Brotherhood, 1318, and the former Jesuit monastery, now a government building. The chief manufactures are gold and silver goods, cigars, lace, yarn, tape, shoes, mirrors and other products. Its pepper cakes and black bread are famous. The city takes its name from Duke Godfrey of Lower Lorraine, who granted a municipal charter in the 12th century. Pope Paul IV established the bishopric here. Pop. 1930, 42,076.

HERTZ, ALFRED (1872-), German music conductor, was born at Frankfort-am-Main, July 15, 1872. He studied piano and composition at the Raff Conservatorium, Frankfort. After conducting opera in Germany, he was retained as conductor of German

opera at the Metropolitan Opera, New York, in 1902-15, where he directed the first American performances of *Parsifal, Salome,* and *Der Rosenkavalier.* In 1915 he was appointed conductor of the San Francisco Symphony Orchestra. He directed summer concerts at the Hollywood Bowl in 1922-25.

HERTZ, HEINRICH (1857-94), German physicist, was born at Hamburg, Feb. 22, 1857. In 1885 he became professor at Karlsruhe where his earlier experiments in magnetism drew the attention of the scientific world and resulted in his being called to a professorship at Bonn in 1889. Here he undertook investigations suggested by Maxwell's equation of light and magnetism and discovered that electrical vibrations agreed, as Maxwell's equations demanded, with the laws of diffusion, reflection, refraction and polarization of light (*see* MAXWELL, JAMES CLERK). He likewise discovered that a high frequency field could be produced by a spark and the waves, since known as Hertzian, capable of reception by a distant coil, the foundation of wireless (*see* HERTZIAN WAVES). He died at Bonn, Jan. 1, 1894.

HERTZIAN WAVES, electromagnetic waves, so called in honor of HEINRICH HERTZ, who was the first to measure such waves and determine their velocity of propagation. In 1864 MAXWELL showed, from theoretical considerations, that the electric and magnetic fields produced by the oscillating discharge of electricity in OSCILLATING CIRCUITS ought to travel out into space in the form of electromagnetic waves, and that the velocity of such waves should be the same as that of LIGHT (*see* ELECTROMAGNETIC WAVES). For some time no one was able to check Maxwell's conclusions by experiment, since no one knew how to construct a detector of such waves. In 1888 Hertz succeeded in devising such a detector, and with it he measured the WAVE-LENGTH of the electromagnetic waves given off by a simple oscillator, determined their velocity and verified Maxwell's predictions. The work of Maxwell and Hertz is the foundation upon which modern science of RADIO COMMUNICATION has been built. L. B. S.

HERTZOG, JAMES BARRY MUNNIK (1866-), South African statesman, was born at Wellington, Cape Colony, Apr. 3, 1866. Anti-British in his sentiments, he served in the South African war, 1899-1902, and bitterly resented the peace terms. In 1907 he served under Fischer as attorney general and minister of education, and in 1910-12 under Botha was minister of justice in the Union cabinet. In 1913 he organized a political party with complete independence as its aim. He was elected prime minister in 1924, and reelected in 1929.

HERVIEU, PAUL (1857-1915), French novelist and playwright, was born at Neuilly-sur-Seine, Nov. 2, 1857. At one time a secretary of the French Legation in Mexico City, he resigned in 1881 in order to devote himself to literature. He began writing novels, but later turned to plays and it is chiefly by these that his name is known. His most successful works are *La Course du Flambeau,* 1901, *L'Énigme,* 1901, *Le Dédale,* 1903, and *Le Réveil,* 1905. Hervieu's plays are simple in action and extremely logical in their development. The tone is austere and sober and all are impregnated with pessimism and a keen sense of pity. Hervieu was elected to the French Academy in 1900. He died in Paris, Oct. 25, 1915.

HERZEGOVINA, a province of YUGOSLAVIA, was until 1918 part of the Austro-Hungarian monarchy. It has an area of about 4,000 square miles and is bounded by Bosnia on the north, by Montenegro on the east and by Dalmatia in the southwest. The province is mostly barren and rocky. Mostar, on the railway between Ragusa and Sarajevo, is the capital.

History. In the 7th century, Herzegovina, then forming part of the Roman province of Dalmatia, was invaded by the Slavs from the north. After existing as an independent principality it was annexed to Bosnia in the 14th century. In 1440 it regained its independence, but by 1486, like Bosnia, it was subjugated by the Turks and thereafter became a scene of bloody strife between Christians and Mohammedans. In 1875 the Christian inhabitants rose against Turkey and though their efforts were frustrated the insurrection contributed somewhat to the RUSSO-TURKISH WAR which followed. The CONGRESS OF BERLIN in 1878 gave Austro-Hungary authority to occupy Herzegovina and Bosnia for administrative purposes. Turkey, however, still retained suzerainty over both provinces until 1908, when Austria-Hungary extended her full sovereignty over them. Upon the disruption of the Austro-Hungarian monarchy after the war Herzegovina was incorporated in the newly created state of Yugoslavia by the Treaty of St. Germain.

HERZL, THEODOR (1860-1904), founder of the political Zionist movement (*see* ZIONISM), was born in Budapest, May 2, 1860. He was educated in Vienna for the Austrian bar, then became a feuilletonist, Paris correspondent of the *Neue Freie Presse* of Vienna and subsequently literary editor of that publication, and playwright. His collected writings and light dramas still find appreciation in Germany and Austria. Herzl however changed the course of his life in 1895 after witnessing the public degradation of Capt. ALFRED DREYFUS in Paris, and devoted himself wholeheartedly to the solution of the Jewish question. He wrote *The Jewish State,* 1896, and followed this by seeking interviews with the Sultan (Abdul Hamid) and organizing the Zionist movement of which he became leader and chief protagonist. In Aug. 1897 he was elected president of the First Zionist Congress held at Basle, Switzerland, and president of the Zionist organization, holding both offices to his death. In 1897 he founded *Die Welt* (defunct), a brilliant weekly to espouse his cause; organized the Jewish Colonial Trust, Ltd., a financial corporation, and the Jewish National Fund; formed a Palestinean land purchasing organization for the inalienable possession by the Jewish people of Palestinean soil.

Politically Herzl succeeded in interesting all the Powers of Europe in his plans. In 1902 he was called as an expert before the British Royal Commission on Alien Immigration, and he negotiated for the acquisition for Jewish settlement of the southern end of the Sinai Peninsula. In 1903 he was received by de Witte and von Plehve in Leningrad; and Plehve subsequently received from the British Colonial Secretary, Joseph Chamberlain, an offer of a charter for mass Jewish settlement in Nairobi, East Africa. In May 1904 Herzl broke down and retired to Alt Aussee to recuperate. He died there July 3, from a heart attack. His grave in Vienna is the scene of a great annual pilgrimage; but the removal of his remains to Palestine, according to his wish, is still held in abeyance, as it would be regarded as a significant political incident.

Politically Herzl was a liberal who advocated a seven-hour day and a cooperative commonwealth, outlined in his novel *Altneuland*. He had a keen perception of the influence of industrialization, and based many of his views on the possibility of introducing mass production in the Near East. He attached more importance than any other Jew in his generation to both the negative and positive effects of anti-Semitism, and therefore sought both political and financial means for the transference of Jewish masses from east European ghettoes to Palestine. Herzl stressed neither Biblical nor Messianic concepts in relation to the Return, but he did employ the widespread Jewish yearning for restoration to Zion in swaying the Jews to support his ultimate goal, the establishment of a Jewish State in Palestine, based on a charter to be granted by the Sultan and approved by all the Great Powers.

J. DE H.

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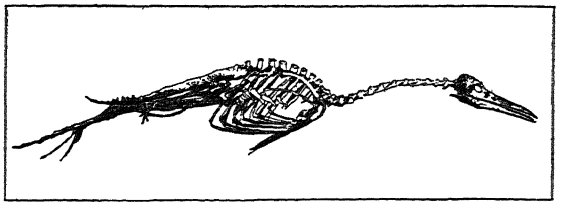
HESIOD (c. 8th century B.C.), ranked with HOMER as the earliest known Greek poet of note. His date cannot be fixed with any certainty; he probably belongs to the 8th century B.C. From his writings it is known that he was born at Ascra, near Mt. Helicon, in Boeotia. After his father's death a lawsuit over the estate was unjustly decided in favor of Hesiod's brother, and the poet in disgust left Boeotia for Naupactus. According to tradition, he was murdered by the sons of his host at Oeneon in Locris.

Hesiod's poetry cannot be compared to Homer's, but his influence among later Greeks as a teacher of practical ethics and religion was very great. Three poems have come down to us under his name. Chief among them is the celebrated *Works and Days,* the earliest extant didactic poem of Greece. It consists of myths, fables, homely proverbs and glimpses of the poet's personal life, intermingled with practical advice to his brother Perses. The *Theogony* is an account of the origin of the universe and of the gods, in which the author strives to arrange the oldest myths of Greece into a connected system; this work has come down to us in a corrupted form, having been subjected to several different recensions and additions. *The Shield of Heracles,* a weak imitation of the Homeric account of Achilles's shield in the 18th Book of the ILIAD, is undoubtedly not Hesiod's, but of later authorship. *See also* GREEK LITERATURE.

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HESPERIDES, in Greek mythology, three sisters named Aegle, Erythea and Hesperis, who guarded the golden apples of Hera, symbols of love and fruitfulness. It was the last labor of Hercules to recover the golden apples and carry them to Eurystheus. *Hesperides* is also the title of a book of poems by ROBERT HERRICK.

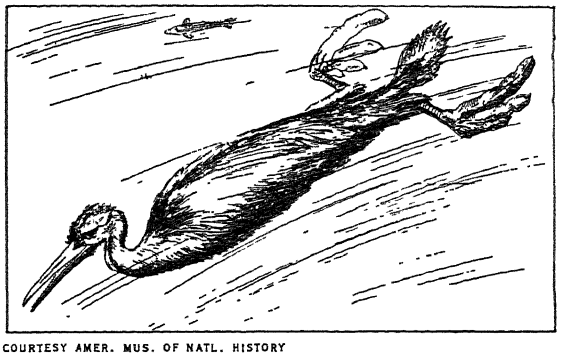
HESPERORNIS, a large, flightless, somewhat reptile-like sea-bird, found fossil along shore lines in the cretaceous formations of Kansas. It measured 5 to 6 ft. in length, was somewhat loonlike in appearance,



COURTESY AMER MUS. OF NATL HISTORY

HESPERORNIS SKELETON

and covered with smooth, soft plumage; but it had a reptilian vertebrated tail and slender toothed jaws. A strong swimmer and diver, it was extremely clumsy on its feet, though it must have hobbled ashore for nesting. It was formidably equipped for fishing, the



COURTESY AMER. MUS. OF NATL. HISTORY

HESPERORNIS REGALIS, THE "WESTERN BIRD"

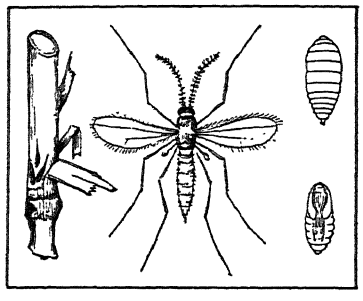
Extinct toothed diving bird of the Mid-Cretaceous Period of Kansas. (From a drawing by J. M. Gleeson.)

flexible neck being adapted to sudden thrusts, the recurved teeth to holding slippery prey, and the capacious jaws to bolting large catches. Among aquatic birds, living and fossil, *Hesperornis* is unique in that it paddled sidewise, with a rowing motion, the legs standing out at right angles to the body, instead of with an up-and-down action.

HESPERUS, the Greek name for the Latin Vesper, the evening star, was the son of Astraeus and Eos. The Greeks associated Hesperus with Phosphorus, the morning star.

HESSE, a republic in southwestern central Germany, comprising two sections, about divided by a narrow section of Prussian territory. One part, Upper Hesse, lies north of the Main River; the other part, comprising Rhenish Hesse and Starkenburg, west and east of the Rhine, respectively, lies south of the Main. There are also 11 small parcels within Baden and Prussian territories. Upper Hesse is mostly mountainous and Starkenburg is occupied by the Odenwald. Hesse forms a transition from south to north Germany, and is mostly drained by the Rhine, which, like the Main, is navigable. The climate is mild in the river valleys and rawer in the mountains. Hesse has a university at Giessen and a technical institute at Darmstadt, the capital. Industry predominates, including the manufacture of iron ware, machinery and leather and wooden goods. Parts of Upper Hesse are very fertile and produce fine wines. The government is essentially the same as that of PRUSSIA and the other German states. The area is 2,965 sq. mi. Of the 1,347,295 inhabitants in 1925, 65.8% were Protestant and 30.9% Catholic.

HESSIAN FLY, a tiny gnat of the family *Cecidomyiidæ*. It is the most destructive insect enemy of wheat. Eggs are laid in the fall on leaves of the young wheat plants. Larvæ hatch soon, and feed near the crown of the plants, often causing them to winter-kill. They pupate in the late fall, protected by the leaf sheaths. In spring the flies emerge, lay



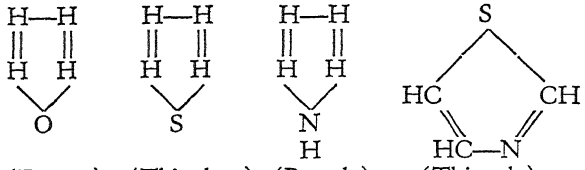
HESSIAN FLY
(Cecidomyia destructor). Pupae on wheat stalk, adult fly, pupa and larva (upper right)

eggs and die. Larvæ of this generation feed in the base of the stem, weakening its vitality greatly. Even if the plant is not killed, the heads fail to produce the normal amount of grain. Pupæ of this generation are found in the stubble. In spring wheat areas there are two summer generations. Stubble should be plowed under and sowing should be delayed ten days or two weeks, so that no flies will be present when the wheat comes up.

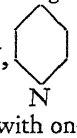
HESSITE, a metallic mineral, ranging in color from lead to steel gray, crystallizing in the ISOMETRIC SYSTEM. It consists of silver and tellurium, usually with some gold, and is a rare and valuable gold and silver ORE. *See also* TELLURIDE; ORE DEPOSITS.

HESTIA, in Greek mythology, the goddess of the hearth and home, the same as the Roman VESTA.

HETEROCYCLIC COMPOUNDS, in organic chemistry, those substances which contain a closed-ring nucleus, comprising at least one other element besides carbon, usually nitrogen, oxygen or sulphur. Although these central rings may consist of from 3 to 8 atoms, those containing 5 and 6 are the most important, and, incidentally, the only ones that possess aromatic properties similar to those of the benzene series. Among the five-membered rings may be mentioned furane (C_4H_4O), thiophen (C_4H_4S), pyrrole (C_4H_4NH), and the dye base thiazole (C_3H_3NS), which, either themselves or in the form of their derivatives, occur in the putrefaction and decomposition products of proteins and whose structural formulae are as follows:



(Furane) (Thiophen) (Pyrrole) (Thiazole)

Of the long series with six-atom nuclei, pyridine, C_5H_5N,  may be considered the starting point; fusion with one benzene ring produces quinoline, with two benzene rings acridine, while other additions give rise to the extremely complex ALKALOIDS, such as nicotine, caffein, cocaine, coniine, brucine, and strychnine; the exact structure of the last two has not yet been determined. The DYESTUFFS of the xanthene series contain oxygen in the ring, while if pyridine is saturated with hydrogen, piperidine ($C_5H_{11}N$) results, again forming the basis of a vast series of compounds.

W. J. L.

HETERODYNE, the action of two radio signals (*see* ELECTROMAGNETIC WAVES) from different sources and of different FREQUENCIES in forming BEATS, as in the case of the signal and local oscillator (*see* OSCILLATOR, ELECTRIC) frequencies in the first DETECTOR of a SUPERHETERODYNE receiver.

HETEROPTERA, a term used by some entomologists to designate the order of true bugs. Others retain the term *Hemiptera.* Formerly the *Hemiptera* included two suborders, *Heteroptera* and *Homoptera.* As now restricted, it includes the former only.

HETZEL, RALPH DORN (1882-), American educator, was born in Merrill, Wis., Dec. 31, 1882. He studied at the universities of Wisconsin and California, and at Dartmouth. In 1908 Hetzel joined the faculty of Oregon State College, where for nine years he served successively as instructor in English, professor of English and political science, and director of extension service. In 1917 he became president of the

New Hampshire College of Agriculture and Mechanical Arts, and in 1923 president of New Hampshire University. Four years later he was elected president of Pennsylvania State College.

HEVELIUS, JOHANN (1611-87), German astronomer, was born at Danzig, Jan. 28, 1611. In 1641 he built a telescope which he employed in the first careful study of surface features of the sun, moon and planets. His work proved the foundation of lunar topography. He engraved his own plates for his maps. He died at Danzig, Jan. 28, 1687.

HEWITT, ABRAM STEVENS (1822-1903), American statesman and manufacturer, was born at Haverstraw, N.Y., July 31, 1822. He graduated from Columbia College in 1842 and after three years of study and teaching was admitted to the bar but never actively practiced law. His father had been an unsuccessful manufacturer of machinery and Hewitt soon entered the same field in association with his brother-in-law Edward Cooper, son of PETER COOPER, with whom he founded Cooper, Hewitt and Company, extensive manufacturers of ordnance for the Federal Government during the Civil War. His plant often ran at a loss and never had strikes.

Hewitt did not actively enter politics until he felt called upon to take a leading part in the reorganization of the Democratic Party in New York City after the exposure of Tweed in 1871. From 1875 to 1879 he was representative in Congress, chairman of the Democratic National Committee and a member of the Joint Committee which organized the Electoral Commission to decide the Hayes-Tilden disputed election. From 1882 to 1886 he again sat in Congress, but his relations with Tammany Hall were now decidedly cool, and only the strength of the rival tickets in the mayoralty election of 1886, Henry George and Theodore Roosevelt, forced Tammany to nominate him for mayor. He was elected, but his break with Tammany soon became open and he was defeated for reelection in 1888.

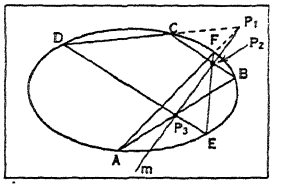
He remained active in national politics, however, advocating civil service reform and sound money policies. On the latter issue he voted the Republican presidential tickets in 1896 and 1900 but did not leave the Democratic Party. He was trustee and secretary of Cooper Union and gave freely to that institution. He was one of the original trustees of the Carnegie Institution and in 1901 was elected trustee of Columbia University. He died at New York City, Jan. 18, 1903.

HEWITT, PETER COOPER (1861-1921), American inventor, the grandson of Peter Cooper, was born in New York in 1861. After studying at Stevens Institute and Columbia College, he entered his father's manufacturing business, Cooper-Hewitt and Co. He invented the Cooper-Hewitt mercury vapor lamp, and a mercury vapor rectifier which effected great economy in the process of changing alternating current to direct current. He also conducted research work in the field of radio communication. Hewitt died in Paris, Aug. 25, 1921.

HEXAGON, a polygon of six sides. If the sides are equal and the angles are also equal, the figure is a regular hexagon.

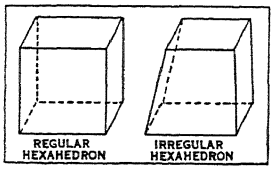
HEXAGONAL SYSTEM, in CRYSTALLOGRAPHY, a system in which minerals are said to crystallize when their faces can conveniently be described by referring them to four imaginary axes intersecting at the center of the crystal. Three of these axes are of equal length and intersect at angles of 60° in the horizontal plane. The fourth is vertical and may be longer or shorter than the others.

HEXAGRAM, MYSTIC, a figure which illustrates PASCAL'S THEOREM that the opposite sides (produced when necessary) of a hexagon inscribed in a conic intersect in three collinear points, one or more of which may be at infinity. In the figure, the vertices of a hexagon inscribed in an ellipse are *A,B,C,D,E,F,* a cross hexagon being taken so as to make the figure small. The opposite sides *AF* and *DC* meet at P_1, *BC* and *FE* at P_2, and *AB* and *DE* at P_3, and these all lie in the straight *m*.



MYSTIC HEXAGRAM

HEXAHEDRON, a geometric solid of six and only six faces. The word is from the Greek and means six-seated. A cube is the most familiar form of a hexahedron, and furthermore it is a regular hexahedron. *See* SOLIDS, GEOMETRIC.



HEXANE, the sixth member of the paraffin series (*see* PARAFFIN COMPOUNDS) of hydrocarbons. Normal hexane has the chemical formula C_6H_{14}. It is a liquid under ordinary conditions, melting at —95.4° C.; normal boiling point, 68.7° C. The specific gravity of the liquid is 0.6641. Hexane is a component of crude PETROLEUM and NATURAL GAS. It is produced commercially by the fractionation of natural GASOLINE and is used as a solvent and as a raw material for the synthesis of various organic chemicals. Most of the hexane present is natural gas and crude petroleum, however, is incorporated in motor fuel.

G. G. BR.; M. So.

BIBLIOGRAPHY.—Shepard, Henne and Midgley in the *Journal of the American Chemical Society,* p. 1948, 1931.

HEXHAM, a market town in Northumberland, England, situated on the Tyne River, 40 mi. east of Carlisle. It contains an abbey, built in the Early English style, with a Saxon crypt and other remains of an ancient monastery. In the market place stands a Moot Hall with two castellated towers, erected in the 14th century. In 1464 Henry VI was defeated by the Yorkists near Hexham. Pop. 1921, 8,843; 1931, 8,888.

HEXING, a modern term, of German origin, referring to the power to bring evil on others by spells and occult ceremonies. The belief survives in cer-

tain districts of Pennsylvania and in 1928 led to a legal trial for murder. *See* NECROMANCY; WITCHCRAFT.

HEYBURN PARK, a state park in Benewah Co., northern Idaho. The park was created from the Coeur d'Alene Indian Reservation in 1908 and contains 7,838 acres, of which approximately 2,333 acres are water. The lower portions of the St. Joe River, said to be the highest navigable stream in the world, are included in the park as well as lakes Chatcolet, Hidden and Beneway and the southern end of Coeur d'Alene Lake. An interesting feature is a hotel, floating on huge cedar logs.

HEYSE, PAUL JOHANN LUDWIG (1830-1914), German poet and novelist, was born in Berlin, Mar. 15, 1830, the son of a philologist. He specialized in Romance languages and literature at Bonn, and traveled in Italy. After 1854 he lived principally in Munich at the court of King Maximilian II, where he produced the enormous total of 20 collections of short stories and about 70 dramatic pieces. Heyse stood at the head of the so-called Munich school of poetry which was opposed to the realistic movement. His works possess the Romance qualities of delicacy and grace, but are lacking in German profundity and earnestness. In the realm of the novelette, of which *l'Arrabbiata,* 1854, is the most famous example, Heyse has few peers. His work here is mostly of Italian life and Italian women, and his style is exquisitely finished. Of his dramas, only 12 have appeared on the stage. In 1910 Heyse received the Nobel Prize for literature. He died in Munich, Apr. 2, 1914.

HEYWOOD, JOHN (c. 1497-1580), English dramatist, was born about 1497. He probably began his career as a choir-boy befriended by SIR THOMAS MORE. His early publication, *Epigrammes,* was very popular. He became a favorite court musician, and in 1538 was master of a boy choir connected with St. Paul's. The "Willow" song in Shakespeare's *Othello* is Heywood's. His plays include *The Foure P's; The Plays of the Wether,* printed in 1533; *The Plays of Love,* 1533, and *Dialogue on Wit and Folly,* 1562. *The Pardoner and the Frere,* 1533, and *Johan the Husband,* 1533, are also attributed to him. In 1564 Heywood suffered exile for his Catholicism and wrote to Lord Burleigh from Malines, Belgium. He is believed to have died in 1580.

HEYWOOD, THOMAS (c. 1570-1641), English actor-dramatist, was born about 1570, and is believed to have been educated at Cambridge. He said at one time that he had written unaided, or collaborated in, 220 plays. Other works include his pageants, his chronicle poem, *Troia Britannica,* 1609, and translations from Sallust, Lucian and others. He played and wrote for Henslowe's company and for several others. Twenty-four of his plays are extant, of which *The Woman Killed With Kindness,* acted in 1603 and printed four years later, and *The English Traveler,* 1633, depicting middle-class life, are outstanding. Heywood was buried at Clerkenwell, Aug. 16, 1641.

HEZEKIAH was king of Judah for 29 years in the 8th century B.C. He restored the worship of Jehovah, which, under his father Ahaz, had greatly lapsed or been mixed with idolatry. The narratives of his conflicts with the Assyrians are in part confirmed by the Cuneiform inscriptions of Assyria. In trying to rid his nation of Assyrian domination, Hezekiah is credited in the Bible with a victory in which "the angel of the Lord" smote the Assyrian host of 185,000 men, so that all "were dead corpses." The Assyrian records contain no confirmation of this. On the other hand the cuneiform records say that Sennacherib invaded Jerusalem and shut up Hezekiah in the city "like a bird in a cage." The act of "the angel of the Lord" is sometimes explained as a pestilence and Herodotus, 250 years later, heard in Egypt that the catastrophe was caused by field mice gnawing the arrows of the invaders while they slept.

HIAWATHA, the hero of *The Song of Hiawatha,* a poem by HENRY WADSWORTH LONGFELLOW, published in 1855. He is the son of Mudjekeewis, the Wind, and Wenonah, the daughter of Nokomis. The poem vividly depicts his childhood and growth to manhood, his hunting and fishing, the wooing of Minnehaha, his search for the mischievous Pau-Puk-Keewis and, at last, his departure for the Islands of the Blest. He had brought many of the arts of peace to his people. *The Song of Hiawatha* is based on authentic North American Indian legends, and is ranked as one of Longfellow's finest poems.

HIBBEN, JOHN GRIER (1861-), American educator, was born at Peoria, Ill., Apr. 19, 1861. On graduating from Princeton University in 1882 he studied at the University of Berlin for a year and at Princeton Theological Seminary 1883-86. From 1887-91 he was minister in Chambersburg, Pa. He was on the faculty at Princeton from 1891-1912 when he was made president of the university. His 20-year administration was marked by important changes in the curriculum, one of these being the introduction of independent research work for the junior and senior classes. He has written several outstanding books on philosophy. Pres. Hibben resigned from Princeton in 1932.

HIBBING, a city in St. Louis Co., in northeastern Minnesota, situated 80 mi. northwest of Duluth. Two railroads serve the city. Hibbing is on the Mesabi Range, and one of the largest open pit iron mines in the world is located at North Hibbing. In 1929 the factory output amounted approximately to $600,000; the retail trade amounted to $8,559,895. Great forests and beautiful lakes are in this vicinity. Pop. 1920, 15,089; 1930, 15,666.

HIBERNATION, a dormant state of existence, accompanied by greatly diminished respiration, circulation and secretion, in which certain northern animals pass the winter. Either hibernation or estivation—a similar comatose condition experienced during the dry season by some animals of hot latitudes—occurs in every group of vertebrates except birds. It is believed that scarcity of food, rather than extremes

of temperature, exerts the greatest influence on estivation or hibernation, thus permitting life to exist where the animals must otherwise starve or migrate inconveniently great distances. Hibernation, often called winter sleep, is sometimes profound and sometimes intermittent. It occurs largely in insect or vegetable eaters. Of the burrowing rodents, nearly all of which hibernate, gophers, chipmunks, and some squirrels store up roots and nuts on which they feast when an occasional warm day rouses them. Bears, commonly considered hibernating animals, are believed not to attain to full coma; in certain species only the female hibernates, giving birth to her young during that period. Mammals seek caves, dens or hollow logs, usually making themselves beds of dry leaves or grass. Reptiles hide among stones, in pits or caves, often coiling together to form a huge, inert mass. Bats also cluster in masses. Many amphibians bury themselves in mud, this being true particularly of those which estivate in dry seasons. Some fish, as the carp, lie quiet on mud bottoms. The larvae of many caterpillars hatch in summer and sleep all winter. *See also* AESTIVATION.

HIBERNIA, the classical name for Ireland. It was known to the Romans through the traders and is mentioned by many classical writers. The Romans never made any conquests here; the first source of information about the island was Ptolemy. The name Hibernia was adapted from Ivernia, the Ivernians being the pre-Aryan race living in Ireland when the Celts settled there. They were hunters and shepherds.

HIBERNIANS, ANCIENT ORDER OF, a benevolent society whose membership is restricted to those who are both of Irish nationality and members of the Catholic faith. The society, an outgrowth of religious disorders in Ireland, was founded in the middle of the 17th century by Rory O'Moore, either at the time of the uprising in 1642 or in 1651 when Cromwell was persecuting the priesthood. For 10 years this organization, known as the Catholic Confederation of Kilkenny, waged war against England in the hope of securing Irish independence. It was in 1829 that the society took its present name and character. Seven years later, it was introduced into the United States and branches were organized in Canada, Mexico, England, Scotland, Australia and Hawaii. At present, the order is working mainly in the interests of a completely free and independent Irish republic and in furthering the study of Gaelic art and literature. In this phase of activity they have endowed a department of Irish Literature in both the Catholic University of America and Trinity College. In this country the Hibernians have in the past greatly aided the Irish immigrants and at present are working for the support of Catholicism and better citizenship among members. The 53,000 members in the United States are all eligible for sick benefits and in case of death, their dependents receive aid.

HIBISCUS, a large and varied genus of plants of the mallow family, comprising about 200 species native to tropical and temperate regions, many of which are grown for ornament and for food and fiber products. The palmately veined leaves are usually lobed or divided; the flowers, often very large, range in color from red to pink, yellow and white; the fruit is a dry capsule. Among the species widely grown for ornament are the ROSE-OF-SHARON and the rose-of-China. The genus includes also the food plant OKRA and the fiber plant KENAF, grown by the Soviet government as a substitute for jute.

HICHENS, ROBERT SMYTHE (1864-), English novelist, was born at Speldhurst, Kent, Nov. 14, 1864. He was educated at Tunbridge Wells and Clifton College, studied music, published lyrics and short stories. His *Green Carnation,* 1894, brought recognition, and *The Garden of Allah* scored even more heavily with the public. Other well-known books are *The Call of the Blood* and *Bella Donna.* Several of Hichens's novels have been successfully dramatized.

HICKMAN, a city in southwestern Kentucky, the county seat of Fulton Co., situated on the Mississippi River, 30 mi. south of Cairo. It is served by two railroads and buses. Cotton, grain and livestock are produced in the vicinity. Woodwork products are the chief local manufactures. The city, founded in 1819, was incorporated in 1837. Nearby is Reelfoot Lake, the result of an earthquake in 1815. Pop. 1920, 2,633; 1930, 2,321.

HICKOK, LAURENS PERSEUS (1798-1888), American philosopher and theologian, was born at Bristol, Conn., in 1798. He studied at Union College and at Western Reserve, and graduated from Auburn Theological Seminary in 1844. Called to Union College in 1852, he was president of that institution from 1866-74, when he retired. Among his writings are: *Rational Cosmology,* 1858, and *Rational Psychology,* 1861.

HICKORY, the common name for a genus (*Carya*) of important timber and nut trees of the walnut family. Seventeen species, together with about twenty-five varieties and hybrids, are known. Except one species found only in China, all are native to eastern North America. They are medium-sized to large trees, with tough, strong, heavy wood, smooth or sometimes scaly gray bark, flexible branches, and pinnately divided leaves. The fruit, a globular or oblong nut, somewhat resembling a small walnut, is encased in a husk which splits into four valves. The kernel, in some species exceedingly bitter, is usually sweet and edible. Among those most highly valued for their strong wood and sweet nuts are the shellbark or shagbark hickory (*H. ovata*), sometimes 120 ft. high, with bark separating in thick plates; the big shellbark or kingnut (*C. laciniosa*), with nuts 2½ in. long, and the MOCKERNUT (*C. alba*), with close smooth bark. Among those with bitter nuts are the pignut (*C. cordiformis*), the water hickory (*C. aquatica*) and the bitter PECAN (*C. texana*). The true pecan (*C. pecan*), with a thin-shelled, well-flavored nut, is extensively cultivated. Hickory lumber, used for many

purposes where great strength is required, is cut in commercial quantities chiefly in the southern states.

HICKORY, a city in Catawba Co. in western North Carolina, situated on the Catawba River, about 50 mi. northwest of Charlotte. Bus lines and two railroads serve the city. Grain, dairy products and vegetables are the chief crops of the region; and cordage, hosiery, and furniture are the principal manufactures. Hickory was founded in 1859 and incorporated in 1874. Pop. 1920, 5,076; 1930, 7,363.

HICKS, ELIAS (1748-1830), American Quaker preacher, was born at Hempstead, N.Y., in 1748. As a young man he became known for his sermons, and left Long Island to preach throughout the eastern part of the United States. An ardent abolitionist, he was one of the first preachers to attack slavery. He rose to be an influential member of the Society of Friends and, when he supported Unitarian beliefs, asserted that Christ had been sent to save only the Israelites, and made other outspoken statements, he caused a schism which divided the society into two factions, the Orthodox Friends and the Hicksites. Among Hicks's books are his *Sermons* and a journal of his life. He died on Feb. 27, 1830.

HICKS, FREDERICK CHARLES (1863-), American educator, was born in St. Clair Co., Mich., Jan. 1, 1863. He received his A.B. in 1886 and his Ph.D. in 1890 at the University of Michigan, where he taught political economy three years. From 1892-1900 he was professor of history and economics at the University of Missouri, and from 1900-20 was professor of economics and commerce at the University of Cincinnati, of which he was made president in 1920. Hicks served in this capacity until 1929 when he became research professor in economics.

HIDALGO, a state of Mexico, situated in the central part of the republic, with an area of 8,637 sq. mi. It is possibly the most mountainous state in Mexico, but slopes to rolling plains in the southwest. Two of the most famous peaks are El Cerro de Navaja, more than 10,000 ft. high, and Los Organos, whose formation resembles the pipes of an organ. The lowlands are covered with tropical trees, and the mountain slopes with pine. The chief agricultural products are rice, and other cereals, besides coffee, tobacco and sarsaparilla. The most important industry is mining. There are about 120 mines in the state, and half as many reduction plants, with an annual ore output valued at about 6,000,000 pesos. A brilliant black obsidian, used by the Aztecs for making cutting instruments, is also found in the state. The capital is Pachuca, and other cities are Real del Monte, Lolotla, Zimapan and Jacala. Pop. 1921, 622,241; 1930, 674,-674.

HIDALGO Y COSTILLA, MIGUEL (1753-1811), a Mexican priest and leader of the first serious attempt to secure independence from Spain. Born in Guanajuato, he became curate of the village of Dolores in the same province. In 1810, after a preliminary attempt had failed, he gathered a force of Indians and mestizos and launched a revolt. His banner with its image of the Virgin of Guadalupe, the patron saint of Mexico, attracted many followers, who adopted the cry, "Long live Our Lady of Guadalupe! Long live independence!" Although successful for a time, his army was not well-disciplined, and after capturing the cities of Guanajuato and Valladolid, was decisively defeated near Guadalajara in Jan. 1811. Hidalgo y Costilla was later captured by one of his disgruntled followers and executed for insurrection on July 30, 1811.

HIDATSA or **MINITARI,** a North American Indian tribe belonging to the Village group of the Plains culture area. They are sometimes called Gros Ventre, a name properly belonging to the ATSINA. Their language is a dialect of the Siouan stock, closely related to the Crow, with whom they are said to have formed a single tribe shortly before the historic period. They live near the junction of the Knife and the Missouri rivers in North Dakota, and have been long closely affiliated with the Mandan and Arikara. They lived a semi-sedentary life, in earth-lodges, using the tepee only as a temporary dwelling; they practiced agriculture, which they probably adopted from the Mandan, hunted the buffalo and used the bull-boat. They celebrated the sun dance and, like other Plains tribes, had a series of military societies for the men. Their three villages were organized into clans. The Hidatsa now live on Ft. Berthold Reservation in North Dakota with the Arikara and Mandan. Their main income is from leased lands, though they also farm and raise cattle and horses, and still continue to produce some beadwork and porcupine quillwork as well as basketry.

HIDDENITE. *See* SPODUMENE.

HIDES, the skin of animals used for making leather, especially the strong, tough skins of mature cattle, horses, and large wild animals. Skins of smaller animals are more commonly known as skins, pelts, or furs.

The value of hides is influenced greatly by skill in skinning, by freedom from injuries caused by brands, ticks, and grubs, and by the care received prior to their marketing. Through trade usage, many specialized terms have been developed to designate different classes and grades of hides. "Country hides" are those taken off by farmers, ranchmen, or their helpers. This class of hides usually shows the result of inexperience in skinning. "Packers' hides" are those of animals skinned in large slaughtering establishments by skilled workmen employed for that purpose. "Fallen hides" is a term applied to those taken from animals that have died from natural causes, in contrast to those of animals slaughtered.

In order for hides to yield a high quality of LEATHER, they must be cured or preserved so as to remain in sound condition until ready to be tanned. Curing is accomplished by thorough cleaning and liberal salting of the flesh side of the hide, using nearly a pound of salt for each pound of hide. When several hides are to be cured they are commonly piled on top of one another, hair side down and heads at the

same end. A clean, cool, well-drained place, without direct sunlight, is desirable for curing and storing hides. Familiarity with market grades and the proper methods of folding and bundling hides sent to market is essential for obtaining the best prices. D. S. B.

BIBLIOGRAPHY.—*Country Hides and Skins,* their skinning, curing, and marketing; U. S. Department of Agriculture, Farmers' Bulletin No. 1055.

HIDEYOSHI (1536-98), Japanese statesman, a peasant's son who rose to control of the entire empire. He entered the service of Nobunaga as a groom, rose to be his chief lieutenant and, when Nobunaga died, in 1582, took his place as the strongest military figure in the country. Eight years later he was civil as well as military master of Japan, under the nominal authority of the emperor. In 1592 he sent an army of 300,000 men to conquer Korea and China. Most of Korea was occupied, but the Japanese troops were repulsed by the Chinese and compelled to give up Seoul, which they had seized. After Hideyoshi's death, the Japanese soldiers were withdrawn to Japan. Hideyoshi at first was largely indifferent to the activities of the Jesuit missionaries, but he became antagonistic as he saw what he believed were their attempts to establish political power.

HIERACIUM, a very large genus of perennial plants of the composite family. It comprises fully 700 species, together with innumerable varieties which by some botanists have been described as species. In English-speaking countries the plants of this genus are commonly called HAWKWEED and in France and Germany they are known by names having the same meaning. There was formerly a widespread belief that birds of prey used the juice of these plants to increase the keenness of their vision.

HIERARCHY, a term derived from Greek words, meaning holy and to rule, and applied in its two senses of celestial hierarchy and ecclesiastical hierarchy. Dionysius the Areopagite enumerates the nine orders of the celestial hierarchy in descending order as: Seraphim, Cherubim, Thrones, Dominations, Virtues, Powers, Principalities, Archangels and Angels. The ecclesiastical hierarchy is the earthly counterpart of the divine hierarchy and includes the entire body of those who exercise authority in the church.

HIEROGLYPHS, sacred writing primarily applied to the ancient EGYPTIAN picture-writing, i.e., representations of figures (man, animal, plant, or parts thereof) inscribed upon stone and other materials to express ideas. Hieroglyphs are either IDEOGRAMS or phonograms, the former being a symbol of a given subject or of some closely connected idea, while the latter expresses a phonetic sound. Official inscriptions such as on monuments, temple walls and graves were executed with great artistic skill and delicacy. The common scribe, however, writing with a reed pen on papyrus or on wooden tablets, developed abbreviated cursive scripts called Hieratic and Demotic.

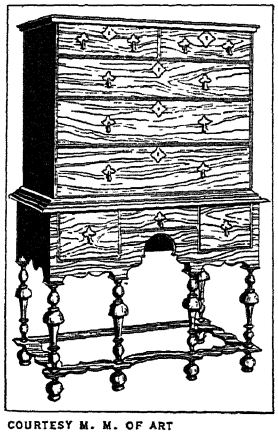
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HIERONYMITES, hermits of several congregations following the Augustinian Rule under the patronage of St. Jerome, founded in Spain and Italy during the 14th and 15th centuries. The Spanish congregation, established near Toledo in 1373, had 25 houses in 1415 and was later introduced into Portugal, occupying the great monastery of Belem, burial place of Portuguese kings. It flourished remarkably during the reign of Philip II, who assigned it the monastery of the Escorial, completed in 1584. Three Hieronymite congregations existed in Italy. Later, both Spanish and Italian congregations were suppressed.

HIGGINS, EUGENE (1874-), American painter and etcher, was born in Kansas City, Mo., Feb. 28, 1874. He studied in art schools in St. Louis and in Paris, and was elected to the National Academy. His work portrays poverty and types of dissolute and ruined humanity. Higgins is represented in the New York Public Library, the Congressional Library, Washington, the Brooklyn Institute, the Los Angeles Museum, the British Museum, London, and the Bibliothèque Nationale, Paris.

HIGGINSON, HENRY LEE (1834-1919), American banker, was born in New York, Nov. 18, 1834. He began as a banker, but abandoned this business to study music in Vienna. After serving in the Civil War, he became a member of the brokerage firm of Lee, Higginson & Co., Boston. He did not abandon his interest in music, however, and supplied the funds, 1881, to organize the Boston Symphony Orchestra and subsequently helped maintain it in its position as one of the best orchestras of the new world. He died at Boston, Nov. 14, 1919.

HIGHBOY (from the French *hautbois,* highwood), an American term for a tall or double chest of drawers standing on high legs, characteristic of the Colonial period. Known as a tallboy, the piece was introduced in England from Holland in the Queen Anne period. It was usually made in two sections, one above the other, for convenience in moving. It was popular until THOMAS CHIPPENDALE and his successors designed different models. The American styles followed the English two or three decades later. Walnut, either carved or inlaid, was the favorite wood until about 1720, when mahogany, very delicately carved, became fashionable. Cabriole legs and claw-and-ball feet were attractive features of the design, along with brass handles and other trimmings.



COURTESY M. M. OF ART

AMERICAN WALNUT HIGHBOY
Turned legs and curved stretchers show continental influence

HIGH COMMISSION COURT, an arbitrary tribunal in England, established on a permanent basis

by Elizabeth in 1583. It consisted of 44 commissioners, many of them laymen, but was controlled by successive archbishops of Canterbury. It restrained ecclesiastical disorders, including immorality; but its handling of doctrinal questions aroused grave discontent. Whitgift as Primate enforced Calvinism; Bancroft emphasized the authority of bishops; Abbot attacked Arminianism; Laud had no mercy for its opponents. On Oct. 22, 1640, the commission sat for the last time, and in 1641 it was abolished, with other arbitrary courts, by statute of the Long Parliament. But in 1686, a new Ecclesiastical Commission was set up by James II. This commission, with other arbitrary courts, was made illegal by the BILL OF RIGHTS.

HIGH COMMISSIONER, an office or title made up of an admixture of diplomatic, military and even constitutional functions. The title varies with country, individual and situation. It is often used in an international sense. England maintained a PROTECTORATE over Egypt, despite the titular control of Turkey and a High Commissioner was sent as her representative. The relation between protectorate and protecting state is essentially an international one. The United States designated Admiral Bristol as High Commissioner to Turkey and the Near East generally during a trying period of Turkey's readjustment, when many rights of Americans were seriously involved. In American practice the office is extraordinary, temporary and deals generally with a special situation. C. E. MA.

HIGH JUMPING, an athletic exercise in which the jumper leaps over a bar placed across two uprights. High jumping is an event in the OLYMPIC GAMES. In the last few years jumpers have so improved their form that they have attained heights once deemed impossible. At the beginning of the 20th century, a leap of 6 feet was considered good, while 10 years later it was believed that 6 feet, 6 inches could never be surpassed. However, in 1924, H. M. Osborn, University of Illinois, jumped 6 feet, 8¼ inches, and no one dares state how much higher the record may go.



GREEK JUMPERS
Arms and legs extended to the front, the contestant is ending a high jump

For many years, a high jumper took a short, fast run, then hurled himself across the bar by taking a hitch kick over it. The modern jumper takes off on one foot and leaps straight up. At the height of his spring, he throws his body lengthwise, parallel with the bar, and rolls over it, landing in a pit of loose earth.

HIGHLAND PARK, a residential suburb of Chicago, Ill., situated in Lake Co., 23 mi. north of Chicago. The city is attractively located on an eminence commanding Lake Michigan, and has adequate transportation facilities. In 1929 the retail trade amounted to $8,739,426. Ft. Sheridan, a United States Military Post, established in 1887, lies immediately north. The population of Highland Park has increased rapidly. Pop. 1920, 6,167; 1930, 12,203.

HIGHLAND PARK, a city of southeastern Michigan in Wayne Co., situated northwest of Detroit, of which it is an industrial and residential suburb. The Grand Trunk Railroad and numerous bus and trucking organizations afford transportation. The development of the automobile industry has been a powerful stimulus to the industrial growth of the city. The chief manufactured products are automobiles, automobile accessories and lumber products. In 1929 the 494 retail stores, which did a total business of $30,961,825, gave full-time employment to 1,919 men and women. Pop. 1920, 46,499; 1930, 52,959.

HIGHLAND PARK, a rapidly growing borough of Middlesex Co., N.J., situated on the north side of the Raritan River facing New Brunswick, N.J., and 27 mi. southwest of New York City. It is served by electric trolleys, connections with the Pennsylvania Railroad and motor bus lines. It is mainly a residential suburb of New Brunswick, but has several industries, the most important of which is the manufacturing of wall paper, printing machinery and water-heaters. Pop. 1920, 4,866; 1930, 8,691.

HIGHLAND PARK, a town of northeastern Texas, in Dallas Co., situated 2 mi. north of Dallas. Two railroads and bus and trolley lines afford transportation. Highland Park is a residential suburb of Dallas. It was founded in 1910 and incorporated in 1913. Pop. 1920, 2,321; 1930, 8,422.

HIGHLANDS, THE SCOTTISH, a region in Scotland north of the Plain of Strathmore, known for its rugged mountain country, particularly on the west coast. The Great Glen of Scotland divides the Highlands. Here are found the lakes Loch Ness and Loch Lochy, now connected with the Caledonian Canal, providing a waterway from Moray Firth to the Firth of Lorne. To the southwest are the Grampian Hills, topped by the highest mountain in Scotland, Ben Nevis, with an elevation of 4,406 ft. The northwest is a sparsely populated, barren district with swamps and moors.

HIGH POINT, a city in Guilford Co., northern North Carolina, situated 15 mi. southwest of Greensboro. Bus lines, two railroads and an airport serve the city. Cotton and tobacco are chief crops of the region. High Point is a manufacturing center for furniture, textiles and hosiery on a large scale. In 1929 the value of the factory output was $52,185,880; the retail trade amounted to $13,826,817. The city was an early Quaker settlement incorporated in 1859. Pop. 1920, 14,302; 1930, 36,745.

HIGH POINT PARK, a state park comprising 10,600 acres in northern New Jersey, donated to the state in 1921 by Colonel and Mrs. Anthony R. Kuser, who had originally developed the region as a private preserve with an extensive deer range. Located on the northern end of the Kittatinny Range, the park contains mountains, lakes and waterfalls, farm lands and forests. High Point is a mountain of 1,823 ft. elevation.

HIGH SEAS, the open, unenclosed ocean, or that part of the seas not surrounded or enclosed between narrow headlands or promontories, that is, the public waters open to use by the whole world. English lawyers hold that the high seas begin at the three mile limit, while American courts hold that it begins at low water mark except in the case of harbors and roadsteads enclosed within headlands or promontories. The Constitution of the United States gives the Federal Government jurisdiction over piracies and felonies on the high seas.

HIGH SILICON IRON. *See* SILICON IRON, HIGH.

HIGHWAY ADMINISTRATION AND FINANCE, involves the construction and maintenance of the road system that carries the national highway transport, and the regulation of highway traffic in all its aspects. Highway finance covers the collection of the funds through taxation and the control of expenditures.

Because of the large sums involved and the technical character of the processes entering into highway construction as well as the necessity for an efficient organization for highway maintenance, highway administration has generally been kept free from political patronage. It is generally concentrated in the state highway departments, only the less important roads being left to the county governments. As the per capita highway expense in the United States is nearly $20 per annum—more than 15% of the whole cost and expense of all governmental activity—efficient administration is imperative.

The highways of the United States are divided into three main classes: 1. Federal Aid System consisting of roads of the greatest national importance and so designated by federal and state highway authorities under the Federal Highway Act of 1921. It is limited to about 7% of the total highway mileage and in 1930 amounted to 193,049 miles; 2. State Roads, or highways of primary importance designated by the states as such and under direct authority and supervision of the States, with a mileage, including the federal aid mileage of 314,136; 3. Local Roads, exclusive of state highways generally joining the smaller towns, and the towns to the farms, with a mileage of 2,710,097.

The administration of the local roads of intermediate or low type construction is generally under county authorities; but generally the state highway authorities have some supervision over the more important units. On January 1, 1930, highway systems, according to the American Year Book, were classified as in the accompanying table, graded and drained local roads being included with unimproved and partly graded roads because of lack of data.

A possible exception to the classification between state and local highways occurs in the case of the counties surrounding big cities where large mileages of high type roads having some of the features of city pavements are required. These systems are laid out to meet the needs of the decentralized community and often involve special types, as parkways, which may often be scenic highways occupying the valleys.

Type	*State Highways*	*Local Roads*	*All Highways*
	Miles	Miles	Miles
Unimproved and partly graded	77,259	2,255,986	2,333,245
Graded and drained	28,553	. . .	28,553
Sand-clay and topsoil	15,442	75,547	90,989
Gravel, treated and untreated	97,838	292,463	390,301
Water-bound macadam, treated and untreated	19,931	48,760	68,691
Bituminous macadam	14,043	16,692	30,735
Sheet asphalt	1,498	1,539	3,037
Bituminous concrete	5,722	4,057	9,779
Portland cement concrete	50,584	13,254	63,838
Brick and other block pavements	3,266	1,799	5,065
	314,136	2,710,097	3,024,233

The financing of local roads is in transition, a considerable part of the funds coming from road taxes and appropriations from general taxes but the tendency is to place more and more of the burden on vehicles through direct registration fees and gasoline taxes. It has been estimated that in 1929 expenditures on the county highway systems involved about $256,000,000 for construction and $260,000,000 for maintenance, and that the funds were derived to the extent of about 15% from vehicle fees and gasoline tax, 10% from bonds, 23% from general funds, and 52% from road taxes.

The state systems are being financed very largely from vehicle registration fees and the gasoline tax. On that part of the state systems where federal aid enters, the expenditure of the federal government is being off-set to a considerable part by taxes on the automotive industry. On all "Federal aid" roads, the control of, 1. The cost of work, 2. Its character, and 3. The specifications for construction is exercised to a considerable degree by the Secretary of Agriculture. This helps to develop national standards. Likewise, due to the contributions by the states to county highway work, the state highway departments has a considerable influence over the expenditures and the character of the work done by county governments. Thus, the "federal aid" system has thus been a factor in raising the standards of highways and of highway administration throughout the country. W. W. H.

HIGHWAYS, as the basis of systems of communication and transportation, have always been most important in the distribution of ideas, knowledge, and goods. Military necessity resulted in a remarkable system of roads tying together the parts of the Roman Empire, many of them so massively built that they survive today. Road building lapsed in the MIDDLE AGES but was revived about 1750 and brought to a high state of perfection for horse drawn traffic. About 1820 when the railway supplanted the stage coach, the highways were again reduced to local roads, but the advent of the automobile about 1900 brought road building into a new phase.

The automobile has required the entire replanning of all road systems. The U.S. Government, through federal aid, assumes a measure of control over highways (*see* HIGHWAY ADMINISTRATION AND FINANCE). The federal system, 193,000 miles in 1930, traverses the country many times in every direction. State highway systems with an additional length of 121,000 miles connect the principal towns of every county. Both systems are being improved with high types of pavement capable of withstanding the continued pounding of rapid moving vehicles, both passenger and truck. About 2,710,000 miles of "farm to market" roads are being improved for all weather use by moderate traffic, under a system of county highways.

Outside of congested districts safe operation of motor vehicles at high speed has required a new set of standards for road design. Location must be on the most direct lines. There must be freedom from obstacles and avoidance of urban areas, or intersections, which either introduce hazards or require serious speed reduction. Alignment must avoid sharp turns, although curves of long radius are a desirable relief to monotony and may well be adapted to the topography; curvature should be slight and curves banked so that prevailing speeds need not be reduced. The horse drawn vehicle is not considered in fixing grades which, however, are as flat as they can economically be made—4% being a desirable maximum, and more than 7%, objectionable.

Ten feet is the standard width for a single lane of a high-speed road. Pavements are accordingly 20 feet, 40 feet, and 60 feet wide. Right-of-way widths between property lines are 60 feet, 100 feet, or 200 feet, which will allow space for shoulders for standing vehicles, for drainage ditches and for the necessary side slopes. Pavement "crowns" are as flat as possible considering drainage—as little as two inches for smooth concrete or asphalt but often 6 to 10 inches on oiled surface secondary roads.

The above characteristics have important economic significance. The cost of operating an average automobile one mile is variously estimated at 6 to 10 cents. An excess mile on a road carrying 2,000 vehicles per day adds over $50,000 a year to the cost of traveling, and the "time value" of a loaded car on a similar road may average $1.00 an hour, so an intersection or a bad curve or grade that involves 30 seconds loss per car may add to the shipping cost over $5000 a year. Since tires wear twice as long on concrete as on gravel, and gasoline consumption is 14 to 40% less, transportation costs justify large expenditures for good pavements where traffic is dense, and excess gasoline consumption on steep grades justify expenditures to reduce them. As funds for Highway Administration and Finance are largely derived from vehicle taxes, the propriety of expenditures to reduce the cost of Transportation becomes apparent.

HIKING, a term applied to extended walking trips or tours of a fairly strenuous nature. During the last 15 years, hiking has become a leading American pastime, and it has the advantage of being adaptable to the individual and to the locality. One of the few mono-sports, sports which one person can enjoy, it is also a group activity of widespread popularity. Young people's organizations such as the Boy Scouts, Girl Scouts, Campfire Girls, Y.M.C.A., Y.W.C.A., Y.M.H.A. and others include hikes on their programs, often as requisite preparation for grades or badges. In cities, hiking clubs have been formed from employees of stores and city departments, among nature lovers of other groups, from groups of newspaper readers and in schools, colleges and churches.

There are in addition loosely organized clubs with widely scattered membership held together by a common interest in a given locality. Many such, as the Adirondack Club, the Appalachian Mountain Club, the Green Mountain Club and others, maintain huts or shelters either for summer or for year-round use of the membership. A small annual fee keeps these simple structures open, and at most of them a moderate charge is made for meals and lodging.

The movement, however, is by no means limited to the United States, other countries, notably Germany, having of late years adopted the hike as a solitary or group activity. In Germany, since the World War, the *wandervoegel* or "wandering birds," groups of young people who set out on tramping tours of the country, have become a recognized feature of national life. The groups are drawn from all classes, but young workers predominate. Shelters or "nests" especially erected or adapted from barns or other local buildings are maintained to accommodate the hikers. In 1920 there were 700 nests in Germany, and by 1926, 2,300, in which 2,100,000 people had been accommodated.

HILARION, ST. (c. 293-371), Palestinian hermit and missionary, was born near Gaza in Palestine about 293, of heathen parents. He studied in Alexandria and was converted to Christianity. After visiting St. Anthony in Egypt, he returned to Palestine, where he distributed his fortune to the poor and became a hermit and ascetic. His fame spread and disciples flocked to him in such numbers that he was forced to organize them into monasteries, thus establishing the monastic system in Palestine. It is said that in late life St. Hilarion visited many countries, among which Egypt, Sicily, Dalmatia and Cyprus are especially mentioned. Everywhere he exhibited remarkable powers as a healer of sickness. He died in Cyprus about 371. This account of his career is based on a life of St. Hilarion written by St. Jerome. St. Hilarion is celebrated in both the Eastern and the Western churches, and his day is kept on Oct. 21.

HILARIUS, ST. (Hilary), bishop of Rome, 461-468, and successor of Leo I, whose legate he had been at the Synod of Ephesos in 449. He defended Roman orthodoxy against the Byzantine Emperor and brought order into the churches of Gaul and Spain.

HILARIUS OF ARLES, ST. (c. 401-449), a wealthy bishop surnamed *Arelatensis,* was born in Gaul about 401. His episcopacy began when he was

but 28 years of age, but in 445 he was deprived of his jurisdiction as metropolitan by Pope Leo the Great, as the result of a quarrel concerning which the evidence is not clear, but which seems to have been about the relative powers of pontiff and bishop. Hilarius died May 4, 449.

HILARIUS OF POITIERS, ST. (?-368), a Gaulish prelate and theologian, surnamed *Pictaviensis,* was born at the beginning of the 4th century, probably at Poitiers, France. He was bishop there in 353, and Martin of Tours is said to have been one of his pupils. He was a strong opponent of ARIANISM, as appears from his extant commentaries, and from his *De Trinitate* and *De Synodis.* He died at Poitiers, Jan. 13, 368.

HILDA, ST. (614-80), Anglo-Saxon nun, was born about 614, her father, Hereric, being the nephew of the king of Northumbria. She was converted to Christianity when she was thirteen years old by the preaching of Paulinus, and entered the monastery at Hartlepool, of which she became later the head. In 657 she became the head of the monastery at Whitby where many celebrated theologians were members. She died in 680.

HILDEBRAND (?1020-85), known also as Pope Gregory VII, was born of obscure parentage at Soano in Tuscany, Italy. He first came to notice as the Benedictine monk whom Pope Gregory VI appointed as his chaplain. Accompanying Gregory into exile, Hildebrand was with him when he died at Cologne in 1048, and after spending a year in the monastery at Cluny, was invited back to Rome by Pope Leo IX. A year later he was created cardinal archdeacon. In his new ecclesiastical rôle he aided in the elections of Nicholas II and Alexander II to the papal chair, and himself succeeded the latter in 1073. The chief event of his pontificate was his dispute with Henry IV of Germany, whom he cited to Rome in 1076 to answer to charges of sacrilege and simony. Henry in anger declared Hildebrand deposed and was in turn excommunicated by the Pope. The German princes who were in alliance with Hildebrand suspended Henry from the royal office, so that to regain his power Henry consented in 1077 to do penance to the Pope at Canossa, receiving a conditional absolution. The excommunication was renewed a year later and war ensued. Henry appointed Clement III as antipope in 1080, and four years later captured Rome. Besieged in the Castle of St. Angelo, Hildebrand was rescued by Robert Guiscard. Hildebrand died in exile at Salerno, Italy, on May 25, 1085.

HILDEBRAND, JOHANN LUKAS (1668-1745), Austrian architect, was born at Vienna, Nov. 14, 1668. After a thorough art education in Italy he returned to Vienna as imperial councillor in 1698 and in 1701 the Emperor Leopold I appointed him court engineer, in which post he designed and constructed some of the most famous buildings in the Baroque style in Austria. Among them are the Belvedere and the Kinsky palace in Vienna and the Mirabel castle in Salzburg. Hildebrand based his work upon Italian models, but he gave the Baroque style a distinctly German development which lasted throughout its entire life in Germany. He died at Vienna, Nov. 16, 1745.

HILDEGARD, ST. (c. 1098-1179), a German abbess noted for her miraculous visions, was born at Böchelheim, diocese of Mainz, Germany, about 1098. Legend calls her the countess of Spanheim. She was sickly as a child and never learned to write, but from her earliest years was subject to visions. She founded the convent of Rupertsberg, near Bingen on the Rhine, in 1148. On the six-hundredth anniversary of her birth, her revelations were first published. She died in her convent, Sept. 17, 1179.

HILDESHEIM, a city in the Prussian province of Hanover, located about 18 mi. south and east of the city of Hanover. It was formerly the capital of a large ecclesiastical principality. The bishopric, originally founded by Charles the Great, was moved to Hildesheim in the first quarter of the 9th century and attained prominence under the scholarly and artistic Bishop Bernward. Bernward and his successors made the city an important center of Romanesque architecture. The private buildings of the Renaissance period, with their stories projecting one beyond the other, highly carved and painted, give the city a unique aspect. The cathedral, built in the 11th century, has been greatly altered. Its artistic treasures are many. The outside of the apse is covered by the famous 1,000-year-old rosebush. Other notable churches are the Romanesque ones of St. Godehardt and the magnificent St. Michael's, both of the 12th century. In 1241, Hildesheim threw off the yoke of the bishop and became a Hanseatic city. It flourished greatly, as shown by the fine secular buildings, as the rathaus and guild houses. The industries include iron foundries, agriculture machinery factories, cotton mills, rubber goods factories, and canneries. The trade is chiefly in sugar, grain and fertilizer. Pop. 1925, 58,522.

HILDRETH, RICHARD (1807-1865), American historian, was born in Deerfield, Mass., June 22, 1807. He graduated from Harvard in 1826 and practiced law in Boston from 1830 to 1832 when he became editor of the Boston *Atlas* and through this medium expressed his hostility to Jacksonian democracy. He vigorously supported the Whigs in the whirlwind campaign of 1840. To combat the spread of slavery, he published *The Slave,* 1836, a novel, and *Despotism in America,* 1854, a book giving the social and economic aspects of this institution. His most important work was the *History of the United States,* published in six volumes, 1849-56, dealing with the period from the discovery of America to the close of Monroe's administrations. The later volumes were colored by the author's strong predilection for the Federalists and his criticism, often unjust, of the Jeffersonian theories and policies. Hildreth traveled widely in South America and Europe, and was residing temporarily in Florence, Italy, when he died, July 11, 1865.

HILFERDING, RUDOLPH (1877-), German statesman, was born in Vienna, Aug. 10, 1877. He studied medicine and practiced for a short time in Vienna, and in 1907 became connected with the socialist newspaper *Vorwärts*, for which during the war he wrote pacifist propaganda. After the war he became a powerful opponent of communism and the leader of the Socialist Democratic party. In October 1923 he accepted the ministry of finance, but had to retire because of the devaluation of the mark. In 1928 he became again minister of finance. His principal works are *Das Finanz Kapital* and *Marx Studien*.

HILL, AMBROSE POWELL (1825-65), American general in the Confederate army, was born in Culpeper Co., Va., Nov. 9, 1825. After graduating in 1847 at West Point, he served in the Mexican War and in Indian campaigns in Florida. At the outbreak of the Civil War, in 1861, he became a colonel in the Confederate army. The next year he was promoted to major-general and took part at the battles of Antietam, Fredericksburg and Chancellorsville. In May 1863, he was made lieutenant-general, and commanded an army corps at Gettysburg and in the Battle of the Wilderness. He was killed at Petersburg, Va., Apr. 2, 1865.

HILL, DAVID BENNETT (1843-1910), an American legislator, was born at Havana, N.Y., on Aug. 29, 1843. He was educated at the Havana Academy, and, after studying law for a time, was admitted to the bar in 1864. He began to practice at Elmira, N.Y. In 1871-72 he was a member of the state assembly. In 1865 he was elected city attorney of Elmira, in 1880-81 alderman, and in 1882 mayor. Running with GROVER CLEVELAND, he was elected lieutenant-governor of the state in 1882, and became governor in 1885 when Cleveland began his first Presidential term. Hill remained governor until 1891, when he was elected to the United States Senate. There he was vigorous in his denunciation of the income tax provisions of the Wilson Tariff Bill of 1894 and in his opposition to the policies of President Cleveland. He again ran for the governorship in 1894, but was defeated by LEVI P. MORTON. He retired from the Senate in 1897, and practiced law in Albany. He died near Albany on Oct. 20, 1910.

HILL, DAVID JAYNE (1850-1932), American diplomat, was born at Plainfield, N.J., on June 10, 1850. He was graduated in 1874 from Bucknell University where he taught Latin and Greek until 1877, was professor of rhetoric until 1879 and served as president until 1888. He was President of the University of Rochester from 1888 to 1896, when he went abroad to study public law. President McKinley appointed him assistant Secretary of State in 1898, and in 1903 Roosevelt sent him to Switzerland as minister. After two years he was transferred to Holland, and in 1907 represented the United States at the second Peace Conference at The Hague. In 1908-11 he served as ambassador to Germany. He is the author of numerous works on diplomatic subjects, including *The Rebuilding of Europe, Problem of a World Court,* and *American World Policies.* Hill died in Washington, D.C., Mar. 2, 1932.

HILL, JAMES JEROME (1838-1916), American railway builder, was born near Guelph, Ont., Sept. 16, 1838. At eighteen he went to St. Paul, Minn., where, in 1870, he organized the Red River Transportation Co. and by arranging connections with the St. Paul & Pacific R.R., established the first communication between St. Paul and Winnipeg. He proposed building a railroad from the Great Lakes to the Pacific, and, despite ridicule, his comprehension of the resources, and his vision of the future of the Northwest, were proved sound, and he carried out his plan. In 1880-93 he built the Great Northern system comprising 6,000 miles of track, and reaching from Lake Superior to Puget Sound. By establishing steamboat connections at both terminals he opened up transportation from Buffalo, N.Y., to China. He became president of the Great Northern in 1893 and that same year acquired control of the Northern Pacific Railway. In 1904, the Northern Securities Co., of which Hill was president, was declared, by the U.S. Supreme Court, to be in violation of the Sherman Anti-Trust laws. He died in St. Paul, May 29, 1916.

HILL, SIR ROWLAND (1795-1879), English reformer of the postal system, was born in Kidderminster, Eng., Dec. 3, 1795. He taught for a time in his father's school but in 1835 assumed secretarial duties for the South Australian Colonization Commission. Soon afterwards he became interested in the postal system which at that time amounted to a franking privilege for government officials and a rate based on distance for paid postage. In 1837 he recommended a prepaid penny rate for all distances inside the Kingdom. His plan was adopted in 1840 and in 1846 he became secretary to the postmaster general. He died Aug. 27, 1879.

HILL. The essential distinction between hills and mountains is one not of size, but of structure. A range of hills truly mountainous in bulk may result from the dissection of a plateau, with no folding or tilting of the rocks such as is involved in the upridging of true mountains. Confusion arises from the haphazard naming of heights. The Catskills, called "mountains," are really hills, cut from the high Allegheny Plateau. Their highest elevations (4,000 ft.) rise, however, above the top of Mount Greylock, the tallest peak in the so-called Berkshire "Hills," which are true mountains forming a part of the Appalachian range.

HILLEL (c. 70 B.C.-10 A.D.), called Hillel I or Hillel the Elder, great Jewish teacher and founder of the School of Hillel. He was the spiritual head of the Jews of Palestine from about 30 B.C. to 10 A.D., during the rule of King Herod. By birth he was a Babylonian and a descendant of the royal house of David on his mother's side. He moved to Palestine at the age of 40, became the disciple of Shemaiah and Abtalion, and finally, after years of privation and suffering, became Nasi, or president of the Sanhedrin,

the Jewish court of law, at Jerusalem, an office which he transmitted to his descendants. He was regarded as the corporealization of Judaism's moral and religious teachings. He laid down "seven rules" for the exposition of the text of Scripture, which played an important part in the later systematic interpretation of the Bible.

Hillel was a Pharisee, and was renowned for his patience, modesty and love of peace. One of his greatest teachings was the negative golden rule, "Do not do unto thy neighbor what thou wouldst not have him do unto thee." The affirmative version of this maxim, found in the Sermon on the Mount (Matthew 22:39-40), is based on it. Other famous dicta of his are contained in the first chapter of *Pirke Aboth,* or *Ethics of the Fathers.* Hillel was the spiritual successor of Ezra the Scribe. His work in the field of legal and religious decisions represented the actual beginnings of the Mishna, or law code, redacted by his descendant Judah Hanasi about the year 200.

Hillel and his disciples (School of Hillel, Hillelites) were much more lenient in their interpretation of the Jewish law than were the irascible and impatient Shammai, his rival, and the latter's school, or body of disciples (School of Shammai, Shammaites). Wherever feasible, Hillel endeavored to relax the law's rigor, and his views invariably acquired the force of law. A. Sh.

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HILLIS, NEWELL DWIGHT (1858-1929), American clergyman and author, was born in Magnolia, Iowa, Sept. 2, 1858. He was educated at Lake Forest University and at McCormick Theological Seminary and entered the Presbyterian ministry. In 1886-95 he held pastorates at Peoria and Evanston, Ill., and then succeeded David Swing at the Central Church, Chicago, an independent institution. In 1899-1924 he was pastor of Plymouth Church, Brooklyn, succeeding Lyman Abbott. He attained a wide reputation by his scholary and forceful sermons and writings which include *A Man's Value to Society, Prophets of a New Era* and *The Quest of Happiness.* Hillis died at Bronxville, N.Y., Feb. 25, 1929.

HILLQUIT, MORRIS (1869-), American socialist leader, was born in Riga, Latvia, Aug. 1, 1869, and emigrated to New York in 1886. In 1893 he graduated from New York University Law School, and began practice. He joined the Socialist Party and in 1888 he became its International Secretary. After 1907 he served on the executive committee of the party and in 1917 he was its candidate for Mayor of New York, polling an unusually large vote. He wrote *History of Socialism in the United States* and *From Marx to Lenin.*

HILLSBORO, a city and county seat of Hill Co. in central Texas, situated 65 mi. south of Dallas. Bus lines and three railroads serve the city. Cotton, corn and small grain are the chief crops of the district; and cotton and cottonseed manufactures are the principal industries. Hillsboro was founded and incorporated in 1853. Pop. 1920, 6,952; 1930, 7,823.

HILLSDALE, a city in southern Michigan, the county seat of Hillsdale Co., situated 90 mi. southwest of Detroit. It is served by the New York Central Railroad. Dairying, stock-raising and grain-growing are the leading interests of the district. Hillsdale has screen door factories, two clothing companies, metal die and gas engine factories and flour mills. It is the seat of Hillsdale College. The site was settled in 1837 and chartered as a city in 1869. Pop. 1920, 5,476; 1930, 5,896.

HILLSDALE COLLEGE, Hillsdale, Mich., a coeducational institution, was founded in 1844 as Michigan Central College at Spring Arbor, Mich., removed to Hillsdale in 1853, and incorporated under its present name in 1855. It is affiliated with the Baptist denomination. The productive funds in 1931 were $835,634. The library of 31,600 volumes contains the Hill Civil War Collection and the Ashbaugh Shakespearean Collection. In 1931-32 there were 496 students and a faculty of 41, headed by Pres. William Gear Spencer.

HILLSIDE, a township of northeastern New Jersey, in Union Co., situated on the Lehigh Valley railroad 1 mi. north of Elizabeth. Local industries include the manufacture of toothpaste, rubber goods, steel and medicines. Pop. 1920, 5,267; 1930, 17,601.

HILVERSUM, a city in the Dutch province of North Holland, 16 mi. southeast of Amsterdam, located on the railroads to Amsterdam and Utrecht. Hilversum manufactures carpets, cotton and woolen goods and has the largest broadcasting station in the Netherlands. Pop. 1930, 57,139.

HIMALAYA, a mountain system dividing Tibet from India and enclosed within the gigantic arms of the Indus and the Brahmaputra. The entire chain, the highest in the world, is the southern buttress of the Tibetan plateau, analogous to the Kuenlun Mountains which border that plateau on the north.

The Mountain Wall. From the Pamir knot in the extreme northwest the great chain of the Himalayas swings in an unbroken, smooth curve southeastwards for 1,500 mi., with a varying breadth of 150 to 200 mi. At first, in Kashmir, the chain is complex, and at least three chains may be separated: the inner Himalayas, or Zanskar range; the middle Himalayas, or Pangi range; and the outer Himalayas, or Pir-Panjal range. At the same time it is scarcely possible to regard as separate the great Mustagh or Karakoram range which flanks the Himalayas on the north in Kashmir. Eastwards the Himalayan chain becomes simpler and a twofold division into the main or inner Himalayas and the outer Himalayas is sufficient. The main range includes Mt. Everest (29,141 ft.); the highest elevation on earth; Kinchinjunga (27,815 ft.) forms a spur from the main range. Makalu (27,790) and Dhanlagiri (26,795) are other giants. Mt. K_2, or Godwin-Austen (28,250), lies in the Mustagh range of Kashmir and is not in the Himalayas.

Passes and Land Routes. The mountain rampart of India is complete, and hence the importance attached to the few possible passes. The weakest region is in the northwest on the Afghan frontier, and it is from this direction that India has been raided again and again. Since the days when ALEXANDER THE GREAT used this door into India it has been a source of danger and remains so to this day. Here lies the most famous of all the passes, the Khyber Pass, though Alexander did not himself use this route. Ancient and medieval traders were accustomed to use routes corresponding closely to the Bolan Pass route from Kalat to Gandava and to the coast route via Sonmiaani. Alexander arrived by a route north of the Khyber Pass and returned by the Bolan Pass. On the north the usual route into Kashmir is from Rawalpindi and Murree to Srinagar. From Srinagar a military road leads to Gilgit and through Hunza, while Tibet is reached from Srinagar across the Zoji-La to Leh and from there the trail leads to Sinkiang (Chinese Turkestan) across the Karakoram Pass. From Punjab to Tibet is the Shipki Pass. Thence for hundreds of miles no route is found across the Himalayas till Darjeeling is reached.

Eastern Region. The great curve of the Himalayas may be divided into two parts, an eastern and a western, mainly on a climatic basis. The eastern mountains lie in Nepal (extending as far west as the western boundary of the state, or the Ganges River), the small state of Sikkim, the district of Darjeeling and Bhutan. Structurally it is simpler than the western tract and is characterized by a heavy monsoon rainfall. It is typical of the eastern Himalayas that they rise very rapidly from the plains. The zone of unhealthy foothills is comparatively narrow. Excluding the foothills and the *Terai* (a long belt of swamp), the Himalayas in the east fall into two parts, the main range and the lower or outer range. Nearly everywhere the main range is 18,000 or 19,000 ft. and Everest, despite its great height, seems to be only one of a chain of peaks. Kinchinjunga, when viewed from the favorite hill station of Darjeeling, achieves fame as the most magnificent mountain in the world. It is the third highest, and its beauty is largely the result of its isolated position. Darjeeling has a rainfall of over 100 in. and may be considered characteristic of the foothills in the eastern half of the Himalayas. The average rainfall in the Himalayas is between 500 and 600 in.

Excluding the sub-Himalayan strip below 5,000 ft., the following zones may be distinguished: evergreen oak forest belt, 5,000 to 9,000 ft.; coniferous forest, 9,000 to 12,000 ft.; alpine belt, 12,000 to 16,000 ft., snow, above 16,000 ft. In the alpine belt rhododendrons are important; sometimes they grow in dense thickets, sometimes as forests of trees with red twisted stems, at higher levels forming merely a heather-like carpet. Just below the snow line the only vegetation may be tufts of grass or mountain plants. Inaccessibility prevents forest exploitation to any extent.

Naturally the density of population is low; almost everywhere it is less than 100 to the square mile, and usually far less. A few villages are scattered among the mountains; they are not large and consist of only a few huts. Nearby is usually a patch of cultivated land—forest cleared by burning, and used for a few seasons only. Most of the hill people are Mongolians; there are numerous races and languages. The Nepalis are perhaps the most important of the hill peoples, though the rulers in Nepal are the Ghurkhas, small, sturdy men, well-known for their qualities as soldiers. The Lepchas usually build their villages in the warmer valleys.

Foothills. The ranges of foothills do not generally exceed 4,000 ft. in height, and are usually covered with damp and unhealthy forest. Indeed, the whole of the sub-Himalayan tract was an unhealthy, malarial region shunned by men, and had the additional disadvantage in the frequency with which earthquakes occurred. Gradually, however, drainage and cultivation have been pushed into the *Terai* swamps. The characteristic vegetation of the hilly parts is a monsoon forest of the valuable sal tree. The sal flourishes especially on the cones of coarse gravel brought down from the hills and known as *bhavar*. The sal forests are an important source of timber.

Western Region. The western Himalayan region includes Kashmir, and not only is the mountain chain itself far more complex than in the east, but the greater complexity is reflected in the vegetation which is more difficult to separate into zones. Broadly speaking, four great parallel ranges of mountains can be distinguished: the Mustagh range; the inner Himalayas, or Pangi range; the middle Himalayas; and the outer Himalayas, or Pir-Panjal range.

The Mustagh range is the highest of all, and there are many peaks more than 25,000 ft. high, of which K_2, or Mt. Godwin-Austen, is the loftiest, and probably ranks second in height among the mountains of the world. This great chain completely shuts off the bleak Tibetan plateau. The inner Himalayas also form a great wall, with many peaks more than 20,000 ft. high. The middle Himalayas are not quite so high, but many peaks exceed 15,000 ft. The outer Himalayas have an average height of 10,000 to 12,000 ft. Between the middle and outer Himalayas is the world-famed Vale of Kashmir. Through the vale wanders the Jhelum River, here broad and navigable and unlike most Himalayan rivers. The hillsides of the vale owe much of their beauty to the wonderfully rich carpet of mountain flowers, while the more accessible hill slopes are covered with terraced fields of fine trees bearing apples, pears and oranges.

The western Himalayas are drier than the eastern, since some of the moisture of the summer monsoons has been lost in blowing up the Ganges Valley. Simla, the well-known hill station, has 62 in.; the total gradually decreases westwards and is often very low in the mountain valleys. The forests usually clothe the northern sides of the mountains, where

they have more shade, so that the snow lies longer and the moisture is not evaporated by the sun. Broadly speaking, the chir pine of the lower slopes gives place upwards to the deodar and blue pine while above 8,000 ft. spruce, silver fir and beech are found. Some of the forests of Kashmir are more accessible than those of the eastern Himalayas. Logs of deodar and blue pine are floated down to the sawmills on the plains.

The Kashmirs are the principal people of the western Himalayas and naturally live in the more sheltered valleys. Below 8,000 ft. the most important crop is maize, but wheat can be grown up to this level. In the wilder parts the only inhabitants are a few wandering shepherds.

Foothills. The *Terai* is absent and the outer and lower strip includes the foothills such as the Siwalik Hills north of Delhi and the slopes of the mountains up to 3,000 ft. This strip is usually covered with a poor monsoon forest or scrub. The most interesting tree in the forests is *Butea,* known otherwise by various native names, such as *chichro, dhak* and *paloh,* and in English as Flame of the Forest, from its red flowers. Probably much of the sub-Himalayan region was once *dhak* forest. *Dhak* yields good firewood and a useful gum; dye can be made from the beautiful flowers, and the dried leaves provide fodder for cattle. But the dry forests of this strip are still more useful for their yield of bamboo, which is important as a building material in the plains. The second strip extends from 3,000 to 5,000 ft. above sea level, and in it the chir pine is common. Turpentine is obtained from the resin of this tree.

Fauna. At great altitudes goat-like animals called the *goral, tahr* and *serow,* as well as the yak are found. On the foothills towards India there are the elephant, rhinoceros, tiger, leopard, monkey and wild cat; on the Tibetan side, foxes, wolves, wild asses, antelopes and ermine are known. Bird life in the forests bordering the plains of India is very rich, and peacocks, partridges and pheasants are plentiful.

HIMERA, a Greek city of Sicily, located on the northeast coast of the island at the mouth of the River Himera. It was founded in 648 B.C. and in 480 was besieged by Hamilcar, the grandfather of Hannibal. The battle of Himera is famous in history the citizens of the town having successfully repelled the Carthaginian hosts, but for this they became the object of enmity of the Carthaginian general. In 409 B.C. the city was destroyed by Hannibal during the Second Punic War with Sicily, and most of its citizens were killed. The following year, a few remaining inhabitants were allowed by the Carthaginians to settle at Thermae, a new town the conquerors had founded not far from the site of the older city. Himera itself was never rebuilt.

HINDENBURG, PAUL VON (1847-), German soldier and statesman, was born Oct. 2, 1847 in Posen. On his father's side he inherited the virtues of the old Prussian nobility, on his mother's, the intellectual vitality of the professional middle class. At the age of 11, he entered a cadet school and at 18 the third foot guards. He joined in the charge on the last five canons of the Austrians at Königgrätz. In the Franco-German war later he distinguished himself in the battle of St. Privat, and served as adjutant of the commander of his regiment at Sedan and Paris. On Jan. 18, 1871 he had the honor of representing his regiment at the proclamation of the German Empire.

On his return from the war, Von Hindenburg's first real training in military science and tactics began at the Kriegsakademic 1873-76. In 1878 he joined the general staff and came under the influence of Moltke and Waldersee. In 1879 Von Hindenburg married Wilhelmine von Sperling, whose father had been a chief of staff. By his marriage he had two daughters and a son, Oskar, who is adjutant in the presidential home.

While stationed in Königsberg in 1881, Hindenburg laid the foundation for his knowledge of the East Prussian defense against Russian invasion. During the next 20 years he alternated his work in the general staff in Berlin with active service in the army, commanding the 4th army corps at Magdeburg (1903-11), when he retired at the age of 64.

Within a month after the outbreak of the World War, Von Hindenburg was called out of retirement to stem the tide of Russian invasion in east Prussia. As commander-in-chief of the 8th army with Ludendorff as chief-of-staff, he crushed the Russian armies first at the battle of Tannenberg (Aug. 24-31) and second at the Masurian Lakes, (Sept. 6-10). These victories enshrined Von Hindenburg in the hearts of the German people and in Aug. 1916 he was appointed commander-in-chief of the German armies. The defeat of Rumania in 1916, the Italian campaign, the crushing of the Russians and the brilliant resistence to the allied offensive in France in 1917, bear witness to the military ability of Von Hindenburg and his chief-of-staff, Ludendorff.

When the debacle of Germany's allies and the conditions at home rendered resistance hopeless, Hindenburg and his staff advised negotiations for peace on Wilson's 14 points. Upon the emperor's decision to expatriate himself, Von Hindenburg offered his services to the German Republic. Loyalty to his country and to his people overcame the old loyalty to the emperor. The next great work was to bring home the 2,000,000 soldiers on the scattered fronts, a task he also achieved with marked success. This accomplished, he again retired to his home.

Upon the death of President Ebert in 1925, the nation again broke in upon his leisure. On Apr. 26 at the age of 78, he was elected president of the German Republic. The nation had implicit faith in his integrity and loyalty to the Republic despite his long service under the emperor. On his part, only an inbred sense of duty led him to accept the Presidency.

During six years of his Presidency, he consistently supported every constructive policy of importance, even to the point of incurring the opposition of

his own Nationalist party. He has made the builders of the German state follow the Weimar Constitution. He has prevented laborers from striking by subduing party dissension. He supported Stresemann in his program of conciliation seen in the Locarno Treaties and Germany's entry into the League of Nations. Under his administration the Rhineland was freed from the French occupation June 30, 1930, five years in advance of the treaty stipulations. He gave loyal support to Chancellor Bruening in the financial crisis of the summer of 1931. To preserve the German state from the attacks of national Socialists on one hand and from the Communists on the other hand, and to come to an adjustment with the foreign powers in the matter of reparations and private debts, Von Hindenburg during the critical months of 1931 stood squarely behind Chancellor Bruening and the minister of defense, Wilhelm Groener, in setting up a virtual dictatorship. He was reelected President in 1932. W. F. V.

HINDENBURG, the largest city in Prussian Upper Silesia, situated in the southeast part of the province; called Zabrze until 1915. In 1905, it merged with four other neighboring districts united by railroad tracks. Later it incorporated Mathesdorf. Mining and the iron and steel industry have developed on a large scale. Pop. 1925, 122,671.

HINDENBURG LINE, called by the Germans the Siegfried Stellung, the strong trench system, protected by heavy wiring, extending from a point east of Arras, in northern France, to the Oise, around St. Quentin and south to a point near Soissons, altogether about 70 miles in length. It was not a continuous trench line, but consisted of a series of strong defenses, such as concrete dug-outs and protected machine-gun positions. In Mar. and Apr. 1917, the Germans made a strategic retreat to the Hindenburg position, relinquishing 600 square miles to reach their well-nigh invulnerable line. The Hindenburg defenses withstood all assault until the British penetration in Oct. 1918. *See* WORLD WAR.

HINDUISM. Making a somewhat arbitrary distinction between BRAHMANISM and Hinduism, we may say that the latter is the religion of modern Hindus, dating from Indian Epic times (roughly, the beginning of the Christian era). A period of 1,000 years, at least, had elapsed, of which we have the record, mainly in the Vedas, the Brahmanas, and the Upanishads. The story of "Hinduism" begins in the two great epics, the Ramayana and the Mahabharata, and continues through the Puranas to the present. It is the story of two major sects, in general, the Shivite and the Vishnuite (*see* SIVA, KRISHNA), or followers of Shiva and Vishnu, respectively. The total number of "Hindus" is about 225 millions, all, with few exceptions, in India proper. Hinduism is not so much one religion as many religions; a museum of beliefs and a medley of rites.

In Hinduism there are involved, sociologically, many "races," and, socially, many "castes." The institution of caste, while absent from the earliest Indian religion of the "Aryan" peoples, may be deemed fundamental to composite Hinduism (mixed of "Aryan," "Dravidian" and other elements). In theory there are four major castes: (1) Brahman, or priestly, although all Brahmans are not priests; all may so act, but most of them earn their livelihood in educational, administrative, clerical, and other forms of service. Brahmans constitute about 7% of the Hindu population; 1,000,000 serve as priests, and more than 1,000,000 are mendicants; (2) Kshatriya, or "ruling" classes —rajas, etc.; possibly, not over five millions in all; (3) Vaishyas, or "mercantile" classes, about ten millions, at most, and, (4) Shudras, or the "Clean," religiously speaking, who make up about 65% of the total. To these loose figures, we may add some forty millions of Panchamas, or "fifth" caste "outcastes." As a class the Brahmans are dominant in Hindu society. Their position, as well as that of all others, is explained by the operation of *karma* and transmigration. A common vernacular word for "caste" is *jat,* or "birth." In reality, Indian caste, unlike any other scheme of classification in all the world, is a development of many combined elements, whose final variations were sealed by religion (Brahmanism), and made theoretically stable with reference to a given existence, or life-span.

Hindu theology recognizes a great triad of gods, Brahma, Shiva and Vishnu. Brahma figures almost not at all in popular religion. Shiva is the most popular Hindu deity; another name is Mahadeva, "Great God," and yet another, Mahayogi, "Great Ascetic." His special seat is Benares, where he is worshiped as Vishveshvara, "Lord of All." He is usually represented not by an image, save when borne in processions, or as seen in domestic prints, but by a "lingam," or pillar. This symbol may be the center of a group representative of associated powers, such as Shiva's son, Ganesha, "Lord of Wisdom," his wife, Durga (or some other name, as Kali), and his bull, Nandi. Shiva acts often, especially in certain parts of India, through his "female" energy (*shakti*), and is so recognized in worship. To the intellectual followers of Shiva, more or less nominal Shivites, only, he is the imminent-transcendent God; to those in the ranks of his worshipers he is served best by austerities, or "works," as one whose wrath is to be feared, although some give him their devotion (*bhakti*) as their Savior.

Vishnu is widely worshiped, not so often directly as through his *avataras,* "descents," or "incarnations." Vishnu, according to Hindu legend, has many times felt such concern for his distressed followers that he has descended amongst them to save them. The most popular forms, *avataras,* of Vishnu are Krishna and Rama, both of whom may have had some historic reality as religious reformers in the pre-Christian era. In fact, there may have been two "Krishnas," one the amorous, musical Cowherd of the Vishnu Purana and the Gita Govind, and the other the more admirable God of the Bhagavad-Gita. There are in India Krishnaites of both types, lower and higher, according to the quality of Krishna. Vishnu is worshiped, also, through his *avatara,* Rama, who with his

wife, Sita, stands for religion of good quality. The story of Rama is told in the ancient Sanskrit Ramayana which is known to the masses in several vernacular versions, especially the Hindi version of Tulsi Das. Rama is to Tulsi Das the Savior of men, the Bringer-in of the Golden Age of truth, purity, wisdom, equanimity, and joy. He is more important



COURTESY METROPOLITAN MUSEUM OF ART

KRISHNA DANCING WITH HIS COMPANIONS
From the Rasikapriyā, a Hindu treatise in verse, by Keseva Dās (1520-after 1601)

than abstraction, sacrifice, prayer, penance, pilgrimage, or the paying of vows. To anyone, of any caste, who will serve Rama with sincere devotion (bhakti) and cooperate with Rama, Rama will grant salvation through his divine grace.

There is a so-called higher Hinduism, of a philosophical character. In prevailing, though not exclusive type, is called Vedanta, and follows from the expositions made by Shankara (c. 800). Vedanta posits one Supreme Spirit, Brahman, "which is this whole world," conceived as absolute, unchanging unity; infinite, eternal, omnipresent, impersonal, unknowable to the world and indescribable. Brahman alone is real; men, beings, objects have no reality of themselves, but are real only as qualities of the One, Eternal Brahman. The world is illusion (*maya*), or, at best, temporary. Man's desirable goal is the "knowledge" that he is one with the eternal, and the realization of this unity. The final release can come only from the Brahman stage, all other castes having to be reborn first as Brahmans. Life in all its aspects must be employed to that end. J. C. A.

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HINDU KUSH, a range of mountains of central Asia, the westward continuation of the Himalayas, extending to the Bamian valley in Afghanistan and separating that country from Turkestan. The mountains continue westwards along the north of Persia, passing into the Elburz Mountains after having given off a great branch which becomes the Caucasus. There are two distinct parallel ranges, a northern and southern. The highest peaks and the deepest gorges are found on the southern range, and lesser variations of relief on the northern. The northern is the primary water-parting, and its drainage escapes through the gorges of the loftier southern range.

The Hunza River rises beyond the southern range and cuts through it. Similarly the Gilgit River drains the trough between the two ranges for 40 mi. and escapes through the southern range; the crests of the two ranges are 13 mi. apart in the basin of the Gilgit. The Kunar River drains the interior of the trough for over 50 mi. and pierces the southern Hindu Kush range at the Ishpirin defile. The Panjshir River drains a great length of the trough and passes through the southern range to the Indus. For a distance of 140 mi. from the Hunza-Gilgit water-parting to the peaks of Titich Mir, the Hindu Kush rises to no great altitude, and the original alignment can in places only be traced by the presence of huge pyramidal masses 20,000 ft. high which have been carved out of the range. No important lakes occur. The beds of the great rivers that pierce the southern Hindu Kush range provide thoroughfares, and consequently the number of well-known passes over this range is not large. The Darkot (15,000 ft.) is perhaps the most important; it crosses the range opposite the Baroghil (12,460 ft.) and Sharvitakh (12,560 ft.) passes to the northern Hindu Kush, which is pierced by a few torrential streams, but by no great river. This range is crossed by a great number of passes: west of longitude 67° there are the Sharak Kushta, the Barkak and several others between 10,000 and 11,000 ft. Farther east are the Irak (13,500 ft.), the Chahardar (13,900 ft.), the Kaoshan (14,340 ft.), crossed by Alexander the Great, and the Khawak (11,640 ft.), a great trade route. There are many more passes; the few mentioned indicate the general elevation of the lowest notches of the range which constitutes a mountain difficult of access and entirely barren and uninhabited. Iron and copper mines occur near Kabul. The importance of this town is due to its strategic position at the western end of the Khyber Pass. An invading army from the Hindu Kush passes must pass Kabul, which is strongly fortified. In 327 B.C. ALEXANDER THE GREAT crossed the range by way of this town.

HINGHAM, a town and seaside village in Plymouth Co., eastern Massachusetts. The village is situated on Hingham Bay, an inlet of Massachusetts Bay, 12 mi. southeast of Boston, of which it is a suburb. It is served by the New Haven Railroad. It is chiefly residential but there are a few factories. A United States arsenal is located here; Derby Academy is located in the center of the town. The Old Ship Church, built in 1681, is an historic landmark. The site was settled about 1633; Barecove Common was incorporated as the town of Hingham in 1635. Pop. 1920, 5,604; 1930, 6,657.

HINSDALE, a residential village and suburb in Du Page and Cook counties, northeastern Illinois, situated 17 mi. west of Chicago. Bus lines and the Chicago, Burlington and Quincy Railroad afford transportation. The village is attractive, with beautiful homes. It was settled about 1835 and chartered in 1873. Hinsdale operates under the Village form of government. Pop. 1920, 4,042; 1930, 6,923.

HINTERLAND, the region of a country lying beyond the coast, often called the back country. The doctrine of the hinterland gives the right of occupation of the country lying inland from the coast to the country occupying the coast, on grounds of contiguity. Title or claim of title by continuity or contiguity is a subject for dispute, and involves the theory of the hinterland. It has been applied to the partition of Africa. It was originally an American theory, and has given rise to claims which can hardly be supported in law and practice.

HINTERLAND of a port. *See* PORT.

HINTON, a city in southern West Virginia, the county seat of Summers Co., situated at the confluence of the New and Greenbrier rivers, 64 mi. southeast of Charleston. It is served by the Chesapeake and Ohio Railroad. Lumbering, coal mining and railroading are the chief interests of the vicinity. The city is becoming a vacation and tourist center, set in gorgeous mountainous country with several beautiful caves and mineral springs. Hinton was founded in 1872 and incorporated in 1891. Pop. 1920, 3,912; 1930, 6,654.

HIP-JOINT, the joint between the pelvis and the thigh-bone or femur. The side of the pelvic bone contains a deep cup-shaped depression, the acetabulum, into which fits the rounded, knob-like head of the femur. The margin of the acetabulum is deepened by a cartilaginous rim and the femur is held in place by a heavy cylindrical ligament surrounding the joint. This capsular ligament is especially strong in front. Another ligament, the round ligament, lying inside the joint cavity, passes from the head of the femur to the acetabulum.

The hip is sometimes dislocated when the leg is forced beyond its normal limit of motion. Usually the lower part of the capsule gives way and the head of the femur slips out of the opening, so that it comes to lie further toward the mid-line of the body. Comparison of measurements of the two sides shows this to be the case.

Hip-joint disease is responsible for a great percentage of crippled persons. It is usually tuberculosis, beginning in the head of the femur in children. Early in the disease the leg is turned outward and the knee bent. This is the position least painful to the joint. To compensate for the shortening of the leg caused by bending the knee, the other side of the pelvis is raised, thus bringing the foot on the unaffected side of the ground. Later, the lower extremity of the affected side is brought closer to the mid-line. To compensate for this the affected side of the pelvis is raised, bringing the corresponding foot off the ground. Rest and fixation of the affected limb are the procedures usually applied for early treatment of hip-joint disease. W. J. S. K.

HIPPARCHUS (c. 160-125 B.C.), Greek astronomer and geographer, was born at Nicaea, about 160 B.C. He lived at Rhodes. Hipparchus inherited and improved the astronomical instruments of his predecessors, and thus was able to detect irregularities in the motion of the moon and the apparent motion of the sun. He observed and recorded the positions of more than 1,000 fixed stars of the 5,000-6,000 visible without a telescope. He is generally credited with discovering the period of the precession of the equinoxes, caused by the slow swaying motion of the earth, in virtue of which the equinoctial points traverse the circle of the ecliptic once in 25,868 years. It is now known that the Babylonian astronomers preceded him in this discovery. Like Aristarchus before him, Hipparchus tried to estimate the size and distance of the sun and moon; but unlike Aristarchus he did not hold that the sun is the center of the solar system, around which the earth and the planets revolve. Like the Greek men of science from Solon and Thales, Hipparchus appears to have owed much to the astronomical knowledge and observations of ancient Egypt and Babylonia. He has received credit for discoveries which in reality he learned from these older observers of the stars. He died about 125 B.C.

HIPPIAS OF ELIS (c. 460 B.C.), Greek sophist, who flourished around 460 B.C. He was a contemporary of SOCRATES. A master of rhetoric, he taught in several cities, particularly Athens. He is recognized by PLATO in his dialogues, the *Hippias major* and *minor*.

HIPPOCRATES (about 460-370 B.C.), according to Soranus, was born on the island of Cos off the coast of Asia Minor at a date corresponding to 460 B.C. He received his first medical instruction from his father, studied at Athens, and acquired extensive experience in travel and practice in Thrace, Thessaly, and Macedonia. The date of his death is unknown, his age being estimated as between 85 to 109. Hippocrates' eminence is threefold: he dissociated medicine from magic and philosophy, crystallized the knowledge of the two schools of medical practice of his time into a systematic science, and gave physicians the highest moral inspiration they have. Hippocrates accomplished for internal medicine all that could be done with no other instrument of precision than an open mind and keen senses. Medicine owes to him the art of observation and clinical examination. Hippocrates founded the bedside method which has been the endowment of clinicians since his time. His method consisted of the use of his mind and senses as diagnostic instruments. This, together with his honesty and his conception of the dignity of the physician's calling, as well as his respect for his patients, has caused him to be called the "Father of Medicine." Hippocrates' writings were numerous and especially characterized by the fact that his con-

tributions were, according to Billings, "written mainly for the purpose of telling what he himself knew, and this motive—rare among all writers—is especially rare among writers on medicine." The writings of Hippocrates are the only contributions of value on the subject previous to the time of Celsus. The law, the Oath, and the opening chapters of his discourse on the *Sacred Disease* are considered the most eminent contributions in Greek medicine. M. F.

HIPPOCRATES, OATH OF. Hippocrates gave to Greek medicine its scientific spirit and its ethical ideals. He dissociated medicine from magic and gave the profession the inspiration which has animated it since his time.

The famous Oath of Hippocrates is the earliest and most impressive document in medical ethics. Most medical historians conceive it to be the ancient temple oath of the Æsclepiads, but Garrison believes that both the Oath and the Law of Hippocrates are so much in accord with what we know of the ethical spirit of the great Hippocrates, that they are usually included in the Hippocratic Canon. The oath is as follows:

THE OATH OF HIPPOCRATES

I swear by Apollo, the physician, and Aesculapius, and Health, and All-heal, and all the gods and goddesses, that, according in my ability and judgment, I will keep this oath and stipulation: to reckon him who taught me this art equally dear to me as my parents; to share my substance with him and relieve his necessities if required; to regard his offspring as on the same footing with my own brothers, and to teach them this art if they should wish to learn it, without fee or stipulation, and that by precept, lecture and every other mode of instruction, I will impart a knowledge of the art to my own sons and to those of my teachers, and to disciples bound by a stipulation and oath, according to the law of medicine, but to no others.

I will follow that method of treatment which, according to my ability and judgment, I consider for the benefit of my patients, and abstain from whatever is deleterious and mischievous. I will give no deadly medicine to anyone if asked, nor suggest any such counsel; furthermore, I will not give to a woman an instrument to produce abortion.

With purity and with holiness I will pass my life and practice my art. I will not cut a person who is suffering with a stone, but will leave this to be done by practitioners of this work. Into whatever houses I enter I will go into them for the benefit of the sick and will abstain from every voluntary act of mischief and corruption, and, further, from the seduction of females or males, bond or free.

Whatever, in connection with my professional practice, or not in connection with it, I may see or hear in the lives of men which ought not to be spoken abroad, I will not divulge, as reckoning that all such should be kept secret.

While I continue to keep this oath unviolated, may it be granted to me to enjoy life and the practice of the art, respected by all men at all times, but should I trespass and violate this oath, may the reverse be my lot.

HIPPODOMIA, in Greek mythology, was wife of Pelops and daughter of Oenomaus, King of Pisa in Elis, and of Sterope, one of the PLEIADES. Oenomaus had been warned that he would be killed by his son-in-law; he therefore said his daughter should marry only the man who could beat him in a chariot race. This Pelops did by bribing the charioteer to loosen the linchpin of the king's car.

HIPPOLYTA, in Greek mythology, queen of the AMAZONS, a warlike race of women living probably east of the Aegean Sea. One of the labors of HERCULES was to obtain Hippolyta's girdle. THESEUS is said to have carried her off after he defeated the Amazons in their warfare with Athens.

HIPPOLYTUS, in classical mythology, son of THESEUS and the Amazon Antiope. (*See* AMPHION.) Believing his son to have tried to seduce PHAEDRA, Hippolytus's stepmother, Theseus asked POSEIDON to aid in punishing the offender. In response the god sent a sea-bull to overturn Hippolytus's chariot as he was driving by the seashore, and he was dragged to death.

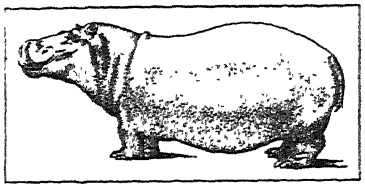
HIPPOLYTUS, CANONS OF, 38 instructions on Church ceremonial usage, attributed to St. Hippolytus (?-236), a presbyter and martyr of the Roman Church, "the most prolific religious writer of the pre-Constantinian era," most of whose works have been lost. Among those preserved are three treatises on canon law, the first two obviously spurious, while the third, the *Canones Hippolyti,* belongs probably to the 5th or 6th century. It exists to-day only in an Arabic version based on a Coptic translation of the original Greek. It was first made generally accessible by the Latin translation of Haneburg (Munich, 1870). The canons deal principally with regulations for the guidance of the Church in ordaining the clergy, administering the sacraments, admitting converts, and in regard to catechumens, religious women, the sick and special cases calling for priestly assistance. The latter part of the Ms. is thought to be by another writer.

HIPPOMENES, in classical mythology, was the son of Megareus and suitor of the Boeotian Atalanta.

HIPPONAX (6th century B.C.), Greek poet, was born at Ephesus in the early part of the 6th century B.C. He was sent into exile by the tyrant Athenagoras in 540 B.C. and settled in Clazomenae. His poems are satirical and follow an iambic meter called "scazon," which Hipponax is said to have originated.

HIPPOPOTAMUS, a mammal (*Hippopotamus amphibius*) of the swine family (*Suidæ*). It is a huge aquatic pig of equatorial Africa, which spends most of

its life in rivers or lakes, and derives most of its exclusively vegetable food from the plants growing therein. It may attain a length of 14 ft., is an active swimmer, and is able to walk and feed on the bottom for several minutes at a time, its nostrils being closed by an automatic valve. Roots of aquatic vegetation



HIPPOPOTAMUS

are grubbed up by the two great tusks in the front of the under jaw, and snag-like canines project from the upper jaw; these teeth grow continually as fast as worn away. At night they wander on shore, and often ravage native gardens. They are of savage temper, and frequently wantonly attack and overturn canoes. Their flesh and fat are used as food, and their hides are variously utilized by the Negroes.

E. I.

HIPPURIC ACID, a substance known chemically as benzoyl glycine ($C_6H_5CO{\cdot}NH - CH_2{\cdot}CO_2H$). It is found in the urine of horses (hence the name), and other herbivora. It may be prepared by heating benzoic anhydride with glycine. It crystallizes in rhombic prisms which melts at 187° C. and are soluble in hot water, are odorless and have a bitter taste.

HIRAM COLLEGE, at Hiram, O., a coeducational institution affiliated with the Disciples of Christ, was chartered in 1850 as Western Reserve Eclectic Institute. From 1856-61, and at intervals until 1866, JAMES A. GARFIELD was principal and lecturer. The institute became Hiram College in 1867. It had productive funds in 1931 of $1,357,017. The library contained 32,000 volumes. In 1931-32 there were 360 students, and a faculty of 30, headed by Pres. Kenneth I. Brown.

HIROHITO (1901-), Emperor of Japan, was born Apr. 29, 1901, the son of Emperor Taisho. In 1921 he visited Europe and in the same year the ill-health of the Emperor forced his retirement and Hirohito returned to Japan as Prince Regent. During his youth as Crown Prince and since becoming Emperor, Hirohito has broken away from the traditional seclusion of the imperial family. These contacts and his trip to Europe have given him an understanding of the modern world. His inclination is toward civilian rather than military domination of the government. He was married to Princess Nagako, Jan. 26, 1924, and succeeded to the throne, Dec. 24, 1926.

HIROSHIGE, (1797-1858). Hiroshige was one of the first of the great color-print makers of Japan to become known to the outside world; and his name, along with Hokusai's and Utamaro's, remains one that all Westerners of culture are supposed to know Indeed it increases in importance as time goes on. At first his work, although admired, was somewhat undervalued; due, probably, to the fact that his prints were much more prevalent than Hokusai's and Utamaro's, but by the time "collecting" had begun seriously, Hiroshige's work became rare and highly-prized.

As an artist Hiroshige is an impressionist and the distinguishing trait of his style is the apparent swiftness and sureness with which the effect has been accomplished. He is a landscapist chiefly, but generally introduces small figures, sometimes many of them, to help out the scene. These figures are so clean-cut and unerringly executed that the uninitiated might suspect them to be cut from colored papers and pasted on, but with all this decisiveness of line there is never a hint of excess line, of so-called "linieness." Every part of the composition is exquisitely balanced. Another piece of stylization that he was fond of was the placing of a band of deep blue at the top of the picture to throw the sky back. Admittedly this is a summary method of painting skies, but in Hiroshige's hands it is an effective one. Also, it enables beginners to easily recognize most of his work.

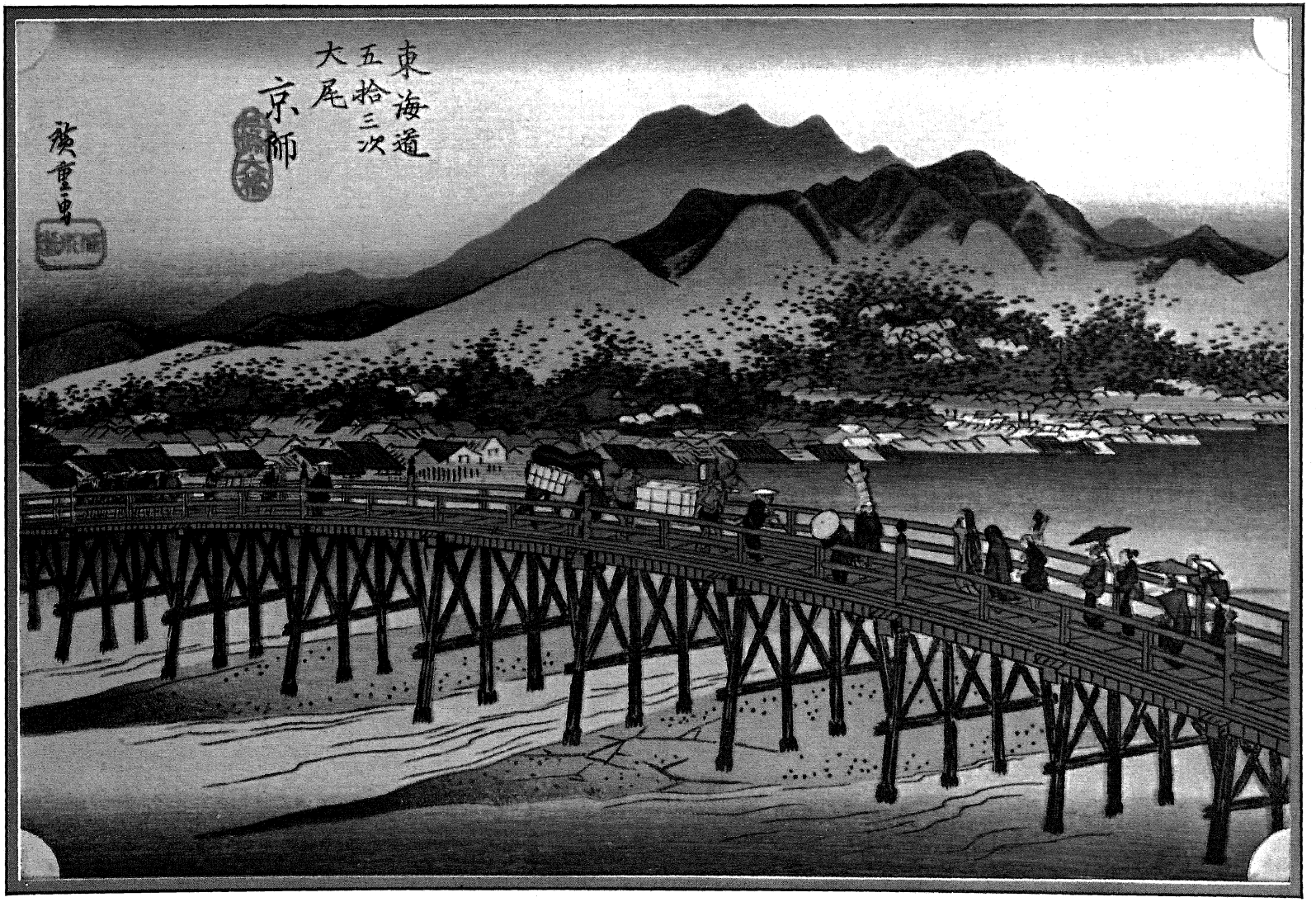
Hiroshige hoped to study with the famous Toyokuni but for some reason that master refused to accept him as an apprentice. Later he was received by Tokohiro and it is from this master he derives his name, his family name being Ando Tokitaro. On the death of Toyohiro he began an independent career, leaving Tokyo for a while to work in Kioto but his growing popularity soon enabled him to return to the capital. His work was much copied and two favorite pupils were named by him, Hiroshige II and Hiroshige III. The work of these two artists follows the convention of the Hiroshige school very closely and has great merit, but it requires an expert to distinguish them. The first Hiroshige died in Tokyo in 1858.

H. McB.

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HIROSHIMA, capital of the province of Aki, in the western part of the main island of Japan, Hondo. It is situated on the Ota River. Oysters, lacquer and bronze and other metal articles are among the trade commodities. The castle of Hiroshima was built in 1594 by Mori Terumoto. After 1619 the city fell into the hands of the house known as the Princes of Geishu, who ruled there as Daimyos until the Restoration. The late Mikado made his headquarters in the city during the Russian War. Pop. 1930, 270,417.

HIRSCH, EMIL GUSTAV (1852-1923), American rabbi and scholar, was born in Luxemburg May 22, 1852. A son of Rev. Dr. Samuel Hirsch, he came with his parents to America when 15 years old, graduated from the University of Pennsylvania in 1872, and then pursued post-graduate studies in Germany, his native land, for five years. After filling rabbinical positions in Baltimore and Louisville, he was elected rabbi of Sinai Congregation, Chicago, in 1880, and was active in that position until his death.



"KYOTO, THE GREAT BRIDGE AT SANJO"

By Hiroshige (1797-1858). One of a series of color prints entitled "Tokaido Goju-santsugi" or "Fifty-three Post Stations of the Tokaido." (The Tokaido is a great road in Japan.) In the Metropolitan Museum of Art.

He was a leader of Reform Judaism in America, and an exponent of radicalism in the pulpit. In 1892 Hirsch founded *The Reform Advocate,* which he edited till his death. In 1892 he became professor of Rabbinical Literature at the University of Chicago, and was visiting professor at Johns Hopkins University and the Hebrew Union College in Cincinnati. He was also a great civic force in Illinois, served as Republican presidential elector at large in 1896, and for years as a member, and part of the time as chairman, of the Board of Commissioners of Public Charities of Illinois and of the Board of Directors of the Chicago Public Library. He was honorary president of the Jewish Institute of Religion in New York. His congregation's Social Center, established in 1910, became a potent factor for social and civic improvement. Hirsch died in Chicago, Ill., Jan. 7, 1923.

M. J. K.

BIBLIOGRAPHY.—*My Religion,* 1925, containing a biographical sketch by his son-in-law, Rev. Gerson Levi; S. D. Schwartz, sketch in the *American Jewish Year Book* for 1925-26; K. Kohler in *Studies, Addresses and Personal Papers,* pp. 544-554.

HIRSCH, MAURICE DE (1831-96), Austrian philanthropist and financier, was born in Munich, Dec. 9, 1831. He was the eldest son of Baron Joseph von Hirsch and grandson of Baron Jacob von Hirsch, the first Jew to be ennobled in Bavaria. In 1855 De Hirsch married the eldest daughter of Senator Raphael Bischoffstein of Brussels, with which firm he had become connected some years previously. He embarked in various profitable financial enterprises, including carrying out a railway concession for building a line from Austria to Constantinople through the Balkans, which subsequently became part of the projected Berlin-Bagdad railway, and through which he increased a large inherited fortune to colossal proportions.

De Hirsch's philanthropic endowments, as augmented by some made by his wife after his decease, aggregated approximately $100,000,000, an unprecedentedly large sum. His philanthropies began in the early '70s in connection with gifts in aid of Turkish Jews and hospitals for the wounded during the Russo-Turkish war of 1878, and assumed gigantic proportions after the death of his son in 1887. His largest philanthropies were: (1) about $55,000,000 to the Jewish Colonization Association, which he founded; (2) several million to the Alliance Israelite Universelle for the Jews of Turkey; (3) about $8,000,000 for the benefit of the Jews of Galicia; (4) about $2,400,000 to the Baron de Hirsch Fund of New York, which his widow augmented to about $4,000,000; (5) about $2,000,000 to his Canadian Jewish foundation; (6) about $1,500,000 to a Vienna and Budapest fund, and (7) about half a million to the Empress of Russia for charitable purposes. The Jewish Colonization Association founded colonies of Russian Jews in the Argentines, now numbering about 200,000 persons, and induced Russia to issue passports to her Jews, emigrating under its auspices, which legalized migration from Russia for the first time, it having theretofore been criminal under Russian law, changing the same from clandestine flight of helpless fugitives. De Hirsch's American foundation established a Jewish colony in Woodbine and an agricultural school there, as well as Jewish scholarships in agriculture elsewhere; founded the Baron de Hirsch Trade School in New York; started Americanization classes for immigrants and promoted agriculture among the Jews of America on a large scale. His gift of his winnings on the turf to London hospitals led to the coinage of the phrase that "his horses ran for charity." He was an intimate of Edward VII while the latter was Prince of Wales, and of other royalties, and divided his time almost equally between Paris, London, the Riviera and Hungary. The 100th anniversary of his birth was extensively commemorated. De Hirsch died in Hungary, Apr. 21, 1896. M. J. K.

BIBLIOGRAPHY.—Oscar S. Straus, *The American Spirit;* necrology in the London *Jewish Chronicle,* Apr., 1896.

HIRSCH, SAMSON RAPHAEL (1808-88), German rabbi and leader of Orthodox Judaism in Germany, was born at Hamburg, June 20, 1808. He was a descendant of a family noted for piety and Hebrew learning, and received a fine Hebrew and Talmudic training from two of the most renowned scholars of the period, Hakam Bernays and Rabbi Jacob Ettlinger. He also studied at the University of Bonn. In 1830 Hirsch was elected chief rabbi of Oldenburg, where he remained until 1841, when he was called to the same office in the Hanoverian districts of Aurich and Osnabrück. In 1836 he published his *Nineteen Letters Concerning Judaism,* under the pseudonym of Ben Usiel. This book created a great sensation through the profundity of its thought and its impressive style. It was a brilliant defense of Orthodox Judaism, its doctrines and ordinances. It exercised great influence in bringing about a revival of interest in the ancient Hebrew faith. In 1846 Hirsch was called to the rabbinate of Nikolsburg in Moravia and in 1847 became chief rabbi of Moravia and Austrian Silesia. In his official capacity as chief rabbi he was also a member of the Moravian Landtag (Parliament). In 1851 Hirsch accepted the call as rabbi of a small Orthodox Jewish group in Frankfort-on-the-Main, because he considered that city a particularly favorable place for the development of his theories of Judaism which stressed loyalty to tradition combined with modern culture. Here he remained until his death, Dec. 31, 1888, and did his chief life-work.

Hirsch was greatly revered by his followers and respected by his opponents. He did not limit himself to his rabbinical functions but was active as an educator and an author. Of his numerous writings, all on subjects related to Judaism, the two best known, in addition to the *Nineteen Letters,* are *Horeb,* a treatise on Judaism for educated youths and maidens, and *Uebersetzung und Erklärung des Pentateuch,* or *Translation and Explanation of the Pentateuch.* The movement begun by Hirsch maintains its strength among German Orthodox Jews, and the congrega-

tion and institutions which he established in Frankfort-on-the-Main have grown in importance. B. D.

BIBLIOGRAPHY.—Ma ence, *Der Israelit*, Jan., 1889; Bernard Drachman, "Samson Raphael Hirsch, A Biographical Sketch," an introduction to the translation of the *Neunzehn Briefe*.

HISTOLOGY, that division of biology which deals with the finer structure of living things. Since in most instances the use of the microscope is required, it is sometimes termed Microscopic Anatomy. The term histology may be limited to the study of the TISSUES. The subdivision dealing with the structure of organs, or tissue aggregates, e.g., eye, heart, kidney and the like, is organology. Since from one point of view the adult structure is the end result of the process of development, histogenesis is as important for the understanding of the tissues as is organogenesis for that of the organs. (*See* ADIPOSE TISSUE; BLOOD; BONE; CONNECTIVE TISSUE; EPITHELIUM; GLAND; MUSCLE; NERVE.)

The structure of organisms is predominantly a direct expression of the physiological or functional aspect of life. While the functional needs are fundamentally alike for all life forms they are nevertheless met in such a variety of ways in the different groups (*phyla*) of animals and in plants that the histology of each presents more or less specific problems. General histology has thus a limited field. Human histology, however, and vertebrate histology are closely related since man shares with other vertebrates a common plan of organization. Plant histology on the other hand has only its cellular organization in common with animal histology. B. F. K.

HISTORY. All definitions of history imply a particular attitude with regard to the past, or a selection of some aspect or phase as of particular importance. Broadly considered, the word history is used in two senses. All past events are history, the events themselves in which historians are interested; or history is the record of all that has happened or appears to have happened in the past. More narrowly, it means the record of human activity and those factors that have influenced it. Since the fundamental aim of the historian is to interpret the present properly in the light of the past, he tends to neglect those events which seem to have no connection with the present. Each generation, therefore, writes its own history. There can be no such thing as an accepted authoritative history written in a past generation, for the perspective is constantly changing, and each author's environment also affects his standards of judgment. No longer is the theory that "history is past politics" acceptable. Political events in themselves are merely the skeleton and meaningless; it is necessary to give them the living form of a past age by reconstructing the economic, intellectual, social and religious environment. History should be based upon all accessible original material, and the amount of research in assembling and studying these documents, the critical use made of them, and the skill in interpretation, are the chief tests of the modern scientific historian.

As research and interpretation, history is a science; but an inverse science somewhat similar to geology or astronomy, in that experiment is impossible and the scholar must proceed from the known to the unknown. Faced with many possible solutions, to explain a given situation, he must decide on the most probable answer. Thus history is an hypothesis, an attempt to account for the existence of facts as they are. In presentation, in narration, history is a branch of literary art. The artistic side tends to receive emphasis in artistic periods of civilization; while in periods of great scientific development, the critical, scientific side of history is most in evidence. Only in its scientific aspects has historical study developed above the level of Greek historiography. Since there is nothing final in the judgment of historians, the reading of historical narrative written in other generations is mainly valuable as literature, or as an aid in showing the intellectual attitude of the age in which it was written.

The earliest narrative history, as contrasted with materials for history, is to be found in tribal songs and race epics, which for the most part cannot be regarded as authentic presentations of the events as they occurred or as contemporary evidence. Nevertheless, they contain memories of events and individuals, exaggerated in passing from mouth to mouth through a series of generations.

Greek Historians. Greek historiography began as a branch of scientific study. To the early Greeks "history" meant the "search for knowledge." With the development of prose writing among the Ionians during the 6th century B.C., at a time when their interest in science and philosophy led to freedom of thought, their interest in their racial myths, genealogies and their contact with Eastern civilizations led to the gradual development of narrative history.

Herodotus, the Father of History, used the word history to refer to the narration of events, and hence from his time the Greeks regarded history as a branch of literature, i.e., an artistic arrangement of a narrative of events, rather than a direct account of what had happened, largely imaginative and artistic rather than scientific. Thus history implied arrangement, style and in addition came to include the advocacy of some theory. The ideal of truth in history was set up by Hecataeus in his *Genealogies*. Herodotus, in telling the story of the Greeks in their struggle against Persia, aimed to please and entertain his audience. His conception of history was entirely dramatic, and truth and accuracy were not essential requirements of a historian.

Thucydides (460-c. 399 B.C.), more advanced, more scientific and artistic than Herodotus, was the first Greek who seriously asked himself the question, "Why write history?" His answer became one of the important canons of ancient historiography. He hoped that his history would be profitable as "a possession forever" by "those who desire an exact knowledge of the past as a key to the future which will repeat or resemble the past." He intended to write a textbook

as a guide to statesmen and soldiers of the future. This argument of the practical utility of history, or pragmatic theory, though out of accord with modern conceptions, was a tremendous advance over previous ideas. Following Herodotus and Thucydides, the majority of ancient historians wrote with the twofold aim of entertainment and of supplying a textbook of practical utility. The idea that history repeats itself, a theory that was still further emphasized when Polybius clearly gave expression to the theory of a cyclical movement in history, led to another typical ancient viewpoint, the lack of an idea of progress. It was natural, therefore, to regard the judgment of a wise man at any time as final regarding the interpretation of historical events. The ancients had very little sense of historical relativity, or of the unity of history, each event being regarded as of importance in itself. There was, in addition, a widespread belief in a decline from a Golden Age. Very early, there developed the canon of "homogeneity of style," in accordance with which ancient historians never reproduced documents or speeches in their original form, and did not reproduce at all such documents or speeches as had been already published. Seemingly this rule was ignored only by Polybius, Suetonius and Nepos.

The great contributions which Thucydides made in historiography were in the field of methodology and critical analysis, built upon the essential principles of critical research, relevancy, accuracy and impartiality. The history of this scholarly, philosophic war correspondent, who first conceived the idea of writing on contemporary events, who stated the fundamental principles of historical criticism, was marred by only two important misconceptions. First, no clear distinction was made between cause and pretext. Causation to Thucydides consisted merely in "immediate human motives" or in the "will of the gods." Each event was the result of a human action resulting from man's passions or motives, irrespective of his environment or of any previous event. And also in accordance with the stylistic dogma of his day, he suppressed all references to sources which he used.

In the 4th century B.C., history writing came under the dominant influence of the rhetorical school represented by Isocrates, Ephorus and Theopompus. This age produced almost worthless histories, biased and uncritical, with a tendency to insipid moralizing, florid speeches, and a passion for panegyrics. A new emphasis, however, was laid on psychological reconstruction, and narrative history was justified as a series of ethical judgments, "philosophy teaching by example." Timaeus of Sicily (352-256 B.C.) was almost alone in the advocacy of a scientific spirit in historiography.

With the expansion of the Greek intellectual world in the Hellenistic period, an interest in universal history developed, and reached its high point in the writings of Polybius and Diodorus. The development of a systematic chronology in this age was one of the most important developments for historical studies.

Greek Influence on Roman Historians. Roman historiography was always completely under the influence of the Greek rhetorical school in methods, principles and outlook. Early histories of Rome were written in Greek, usually in annalistic form. The first narrative in Latin, written by a Roman, was composed just after the First Punic War, and closely imitated Greek models. In the majority of cases the ideal of truth was sacrificed. There was little research. There was a constant catering to national vanity. And many historians were most intent on psychological analysis, brilliant epigrams, and an even more intensely ethical viewpoint, than the rhetoricians of the Hellenistic period. History became merely a branch of rhetoric. Suetonius stands out as one who violated many of the ancient canons of historiography and, in the opinion of his age, sinned most in paying little attention to rhetorical style.

Beginning with the Augustan period, little distinction can be made between the Greek and the Roman schools of historians. History consisted largely of satires on the degeneracy of the Empire, either for political motives or as desirable studies in ethics. The one outstanding contribution of the Roman period was the reestablishment of the form of universal history, which had been last adequately treated by Polybius. In the imperial age, however, the idea of universal history was based fundamentally on the Stoic ideas of the brotherhood of man.

Tacitus, Sallust and Livy in order of importance were the greatest of Roman historians. Tacitus, the first type of historian with his eyes fixed on the present while telling the story of the past, aimed especially to advocate political views. As a master of literary style he far surpassed the Greek historians. After him, Roman historiography suffered a very rapid deterioration. The lowest point came in the 4th century, when a lessening of interest in the history of the past led people to be satisfied with epitomes, manuals and handbooks, mere compilations involving little effort and no originality.

After the disruption of the Roman Empire, classical models of historical writing and the principles and methods of ancient historiography were neglected in Western Europe, while in the Byzantine Empire the writing of history along classical lines persisted, but showed a lowering in matter and style. Ammian was the last important pagan Roman historian.

Early Christian Historians. New theories and principles came in with the early Christian historians. Due to religious interest, an emphasis was laid on universal history. The cyclical theory of the ancients was eliminated as incompatible with Christian belief, and there was little sense of further progress on earth. In place of the best scientific theories of Thucydides or Polybius, vicious principles were developed which handicapped a rational treatment of historical development.

Causation became merely the superior guidance of an indefeasible divine authority, a "God in history" theory, which persists from that day to this. The

tradition of divinely revealed Jewish records, the concept of the Jews as the forerunners of Christianity, led historians to give an absurd relative importance to Hebrew history and to draw the line between Christian and pagan clear back to the Creation. Moreover, pagan history was almost completely neglected due to the fervent bias against it, except in so far as it could be used as a bad example in contrast to the blessings and peace of Christianity. This view gained easy acceptance during the medieval period, as the people of Western Europe saw no direct connection between their civilization and that of ancient paganism.

The pragmatic conception of history received even more emphasis than before, while the underlying principle appeared to be the eternal struggle between good and evil. The Greek and Roman freedom of handling source materials was a thing of the past. Obviously, a scientific criticism of documents which were believed to be divinely revealed was impossible. The only way out was by some means of allegorical and symbolical interpretation. A critical attitude was further rendered impossible by the dominance of Neo-Platonic philosophy, which taught the superiority of emotions and intuition over reason and intellect. This resulted in an unbounded credulity, and the blind acceptance of the most miraculous and impossible stories. History was, moreover, sharply divided into two fields, sacred and profane. And the profane was seldom touched upon. However, there was one very important advance: attempts were made to synchronize the events in Hebrew and Gentile history. Finally, due to the studies of Eusebius, Julius Africanus and St. Jerome, an official Christian chronology was established, the Era of the Birth of Abraham.

The church theory of history became the dominant view after the successes of Christianity in the 3rd and 4th centuries. The *Ecclesiastical History* of Eusebius (260-340) was the first and most erudite systematic history of the Patristic period. Though relatively impartial and based upon a great amount of research, it was superficial in analysis. Eusebius was, however, the first to handle Christianity along historical lines, the first to attempt a fair treatment of Judaism, and the only historian to give an account of any importance for the history of early Christianity. Socrates, Sozomen and Theodoret continued the story of Eusebius in the 5th century, and the whole account was compiled and translated into Latin by Cassiodorus in the 6th century. This Tripartite History became the main source of historical knowledge concerning early Christianity during the Middle Ages.

The violent hatred of paganism is best shown in Orosius's *Historiarum Adversum Paganos libri vii,* written in the 5th century at the suggestion of St. Augustine, and intended to be a supplement to his *City of God.* This first Christian world history, with the viewpoint that history is the account of God's guiding humanity, contrasted the horrors of pagan eras with the blessings of the Christian epoch. Orosius is of importance, however, only because his work, along with the Bible and the Tripartite History and St. Jerome's reconstruction of Eusebius's *Chronica,* remained until the period of the Renaissance the standard text on universal history, the main source of historical knowledge during the Middle Ages.

Medieval Historiography. Several centuries passed after the writings of the Patristic historians before there was any development of importance in historiography. The link between ancient and medieval history writing is found in the lists of the consuls, the Fasti Consulares, which give occasional mention of undated historical events, down to the 6th century. Historiography was hindered as there was no generally accepted era for reckoning dates in early medieval western Europe, the Era of Abraham being of value only for pre-Christian history. History writing recommenced, however, when calculations for Easter forced the working out of a new era, the era of the Incarnation. Suggested by Denis the Little (c. 525), this era was apparently first used in historical works in England in the 8th century, and was carried to the Continent in the 9th century by Anglo-Saxon missionaries, who took with them Bede's important study, *De Temporum Ratione.*

A common methodology and interpretation make it difficult to differentiate absolutely between the annalists, chroniclers, biographers and systematic historians of the medieval period. The annal began probably when monks jotted down in the Easter Tables what they heard or knew about contemporary events, without orderly arrangement and seldom with comment. Later the chroniclers attempted to weave their story into a regular record and usually commented piously on the events. Whether annal or chronicle, and both were written throughout the Middle Ages, the majority were composed in the scriptoria of monasteries, though there are some notable exceptions in the famous city chronicles of Italy and Germany.

The historian of the Middle Ages aimed at relating facts as they happened, but in a more elegant manner than the chronicler, whose work was characterized by a simple style and a great deal of attention to chronological arrangement. Medieval historiography lacked perspective, and in dealing with the past the judgment was usually very faulty. Historical works were full of tales of the miraculous, related with a blind belief in the truth of legends. Most of the annals and chronicles are quite untrustworthy unless they can be checked by other evidence.

The most famous of early medieval historians was the "Venerable Bede" (675-735) whose *Ecclesiastical History of England* portrayed the early history of Christianity in England. After him, history writing lagged until a short revival took place in the time of Charlemagne. The lowest ebb of history writing in France and Germany came in the 9th and the first half of the 10th century. A new beginning was made in the last half of the 10th century in the time of Otto I; but these writings were histories rather than chronicles, as seen in the work of Otto of Freising or

Liudprand of Cremona. The chronicles of the 11th. 12th and 13th centuries made rather steady advances in method and style, and were marked chiefly by the greater range in time which they covered.

The outstanding example of a chronicle written in the vernacular was the *Anglo-Saxon Chronicle* in England. There were none on the continent until much later. From the 12th century, however, chronicles appeared written in the vernacular on the continent, when native languages were coming into literary use. These appeared first in songs and poems about national traditions and heroes, such as the *Chanson de Roland,* and were later followed by chronicles in prose. The first continental history in the vernacular which was of any consequence was Villehardouin's *Conquest of Constantinople.* Typical of this group were Froissart (1337-1410), the chronicler of chivalry, and Philippe de Commines (1463-1509), the historian of the relations of Louis XI and Charles the Bold.

In all the works of the Middle Ages, the treatment emphasized the unity of mankind and dealt with universal history, using earlier works as a preface and reserving the original part of the story to contemporary history, which was almost exclusively episodical in treatment. There was little attempt until near the close of the period to analyze the deeper, social, economic or intellectual forces in historical development.

A Western European method of conceiving and writing history was developing rapidly in the 14th century, when the discovery and study of the famous works of ancient historians caused an imitation of classical histories in the Renaissance period to take the place of any natural development.

The Renaissance Period. The knowledge of Greek and Roman historiography given to Europe by Renaissance scholars restored the tyranny of rhetoric, and truth was relegated to a position of secondary importance. History became an aid to classical studies resulting in faulty perspective and impossible relative proportions, attention being devoted almost exclusively to such questions as the Persian War, the Peloponnesian War, the Age of Cicero, and the Augustan period. The Renaissance historian often preferred to rearrange historical events in order to bring out political or moral lessons. He rather contemptuously regarded critical students of documents and collectors as mere antiquarians. The most valuable work, however, was accomplished by the much despised antiquarians, who discovered and edited manuscripts. The canons of Livy and Tacitus were followed rather than those of Thucydides or Polybius. Although historical writing was not freed from the subservience to vested interests and authority, it was to a large extent emancipated from a theological bias. With the secular spirit of the Renaissance there was the reappearance of the cyclical theory and a new interpretation of the direct utility of historical studies. Many Renaissance historians were content to imitate the ancient classics in style and historical principles, but turned to the history of their own times to inculcate political lessons or defend some 15th century political party. The outstanding examples of this group were Machiavelli (1469-1527) and Guicciardini (1483-1540), whose histories of Florence exhibited all the characteristics of the Renaissance school of historiography. Spanish and Portuguese historians imitated the ancients in stylistic treatment, but gave epic stories of the achievements of their countrymen in the New World or in Asia. Preeminent among these was the Portuguese historian Joao de Barros (1496-1570) who in *Da Asia* dealt with contemporary events after the manner of Livy.

As a reaction to the hated medieval period, causation became quite secular, and the miraculous element was eliminated from historical narrative. North of the Alps, and especially in the Germanies, where there was no close connection with classical peoples, historians became much interested in collecting source materials for the history of their own country.

The critical work of the Humanists was to a large extent checked by the Reformation, which gave a fervent religious orientation to historical interest. Impartiality was cast aside, and in the heat of religious controversies a conscious attempt at biased accounts for the purpose of proving a theory resulted in many worthless histories. Much energy was consumed in scanning the records of the medieval period in order to prove, by showing the accord between the Lutheran doctrines and those of early Christianity, that while the Catholic Church had drifted away from primitive Christian beliefs and organization, the historicity of the Lutheran position was unassailable. With equal determination, Catholic historians strove to refute these claims. The only permanent contribution of real value was the recovery and publication of important documents dealing with the history of the Church.

Modern Historiography. More important than either the Renaissance or the Reformation in shaping the development of modern historiography were the influences of the Age of Discovery, the Commercial Revolution, and the political rivalries of the 16th and 17th centuries. Knowledge of new worlds broadened the historians' interest; more attention was paid to the manners and customs of a people; ethnography and geography assumed a new importance in historical writing. The totality of civilization was deemed well worthy of treatment, and seemed to confirm the conception of a law of nature in which the 17th and 18th centuries so firmly believed. More attention was paid to the economic factors in the development of civilization than ever before.

Historical style became that of comprehensive description rather than a mere chronological narration, a change made necessary by the new type of subject matter. Nevertheless, the influence of classical models may be seen throughout the 17th century. Literary style was still of primary importance, and the utility of history in teaching moral or political lessons remained a favorite thesis. Sir Walter Raleigh (1552-1616) wrote his *History of the World* while in prison, for the purpose of teaching political lessons; the philosopher Hobbes (1588-1679) wrote his *Behemoth* in

imitation of Thucydides; de Thou (1553-1617) wrote his *Historia sui Temporis* in imitation of Ciceronian Latin, and Bossuet (1627-1704) gave a most eloquent interpretation of the hand of God in history in his *Discours sur l'histoire universelle.* The latter's idea that history culminated at a certain point was of particular importance in historiography as it influenced the viewpoint of 18th century historians.

As a result of the prevailing religious interpretation in history prior to the 17th century, it had been customary to divide the whole field into three periods of about 2,000 years each. Mankind lived in a state of nature from the creation to Moses, under the rule of law from Moses to Jesus, and under the blessings of Christianity ever since. Bodin accepted the division of history into three 2,000-year periods, but gave an entirely new and secular interpretation when he characterized each era by racial predominance, i.e. the Oriental, the Mediterranean, and finally the Northern European. During the same period many antiquarians formed collections of source materials of the greatest value to future historians. Great national collections of manuscript materials were gathered together by such investigators as Leland, Bodley, Dugdale, Duchesne and Muratori.

In addition, historical scholars began to study methodology after Jean Bodin (1530-96) published the first modern treatise on the subject in his *Methodus ad facilem historiarum cognitionem.* He emphasized interpretation rather than criticism of the sources, discussed the influence of geographical factors in history, and even hinted at the continuous progress of civilization, a theory first clearly stated by Pascal about the middle of the 17th century. The most important treatise on history in the early modern period was written by Gerhard Johann Voss in 1623, and entitled *The Historic Art, or Concerning the Nature of History, and of Historical Method and Rules for Writing History.* Yet, after stating emphatically that truth was the essential aim in history, he expressed the generally accepted interpretation of his time by finding its chief value in its great moral and political lessons.

The predominance of literary style in historiography reached its height in the 18th century, in spite of the revolt against classicism which was one of the characteristics of rationalism. Voltaire, the founder of the rationalist interpretation of history, attacked the slavish imitation of the classics, but was hardly more tolerant of those who insisted on the value of original source materials. The reaction of the new scientific philosophy on history writing had important results. The idea of progress and of the perfectibility of human institutions and human nature became a fetish. It was held that social no less than natural processes showed an orderly development. Late in the century much was made of the theory of historical continuity and the cumulative nature of progress. These ideas were a most important change in historiography, as they led to the abandonment of the ancient and medieval theory of man's descent from a Golden Age, and of the medieval conception of Christian civilization as static. There was also a uniform tendency to enlarge the field of historical studies to include many subjects formerly neglected, such as the history of literature, commerce, art or law. The international and cosmopolitan ideas of the 18th century found expression in universal history, or in the history of non-European peoples. In spite of the tendency to emphasize purely natural causes rather than the arbitrary acts of a divine Being, the theory of causation was still rather primitive in its simplicity. One of the most glaring misinterpretations of 18th century historiography was the exaggeration of the possibility of abrupt changes in social and political institutions, the catastrophic theory that great movements were often the result of a single isolated event. This led writers to lay an undue emphasis on some of the more dramatic events in history, such as the fall of Constantinople, as originating a new epoch in civilization. It resulted also in the labeling of historical periods, such as the "Dark Ages," and the "Age of Enlightenment." The spirit of revolt against all the old authorities was the keynote of rationalistic thought. Voltaire was the first to give credit to non-Christian contributions to civilization, the first to put political history in its proper relation to economic and social developments, and the first to use a topical method of treatment. William Robertson was the first to make clear the major outlines of constitutional development in the Middle Ages. Vico further developed the modern dynamic theory of progress and yet, rather inconsistently, restored the cyclic theory to a place of prominence. Turgot was one of the first to set forth clearly the idea of the continuity in history, the cumulative nature of progress, and the causal sequence between different periods of history.

Archaeological Study. While narrative history was developing so rapidly, antiquarians in every country of Europe, with the exception of Spain (due to the influence of the Inquisition), spent their lives in collecting, editing and publishing original sources for the histories of their respective countries. Other scholars were developing for the first time those important principles of criticism and the auxiliary sciences which were to be of so much value to historical scholars in the 19th and 20th centuries. In the 17th century critical work was begun again by Bayle in his *Historical and Critical Dictionary;* DuCange produced his still authoritative glossaries. Practically all the tools necessary for textual criticism were forged by one of the great groups of historical scholars of all time, the Benedictines of St. Maur, in the 17th and 18th centuries. No rules for establishing the genuineness of a text had been formulated prior to Dom Mabillon's *De Re Diplomatica,* in which he established the science of diplomatics. Dom Montfaucon, Dom Clement and others founded the sciences of palaeography, epigraphy and chronology. Still another great organization of scholars, the Bollandists, founded the principles of internal criticism in order to interpret medieval documents properly. The dis-

covery of Herculaneum and Pompeii early in the 18th century marked the beginning of archaeological study, which has done so much to bring within our ken those ancient civilizations which were formerly absolutely unknown.

The culmination of 18th century history writing was the production of *Decline and Fall of the Roman Empire* in 1776. Gibbon set down anew all of the canons of scientific research; he used extensively the collections built up by the antiquarians, and applied the scientific tool of the scholars to good advantage. This he combined with a masterly style. As far as factual detail is concerned, he was amazingly accurate; but, as is to be expected, his work is marked by some startling misinterpretations, such as the harsh judgment on the civilization of the Byzantine Empire.

Romantic and Scientific Interpreters. A reaction against the rationalist interpretation of history soon set in. It developed gradually and ranged all the way from the moderate rationalism of Montesquieu, through the emotional sentimental idealism of Rousseau, to the mystic ideas of the true Romanticists. This reaction, due in England largely to the influence of Sir Walter Scott, was further strengthened on the continent by the results of the French Revolutionary and Napoleonic periods when artificial political and social constructions failed, thus apparently disproving the catastrophic theory of causation. The Romanticists were usually literary men attracted to history by the fascination of certain topics, ideas or individuals. Their treatment of history was more subjective than objective, and was impressionistic in that it aimed at reproducing the "atmosphere" of the past. Some historians developed a doctrine of the gradual and unconscious nature of cultural evolution; others emphasized the organic unity of a nation's history and the development of national cultures in a way that defied a rationalistic interpretation. Still others developed a theory of political fatalism, out of which grew a philosophy of political quietism which was identified with national stability. Romanticism often centered its attention on national history, and for each nation the Middle Ages was considered a most important period, for then it was that national cultures, national institutions and national tongues were considered to have become fixed.

Contemporaneous with the full development of the romantic interpretation, with its love of the colorful and dramatic, there was established the coldly critical modern school of scientific historiography, due largely to the writings and teachings of the two great German scholars, Niebuhr and Ranke. Under their influence history became constantly more objective in treatment, and the doctrine of detachment from the present was generally accepted as an aid to impartiality.

The 19th century witnessed the most rapid growth of historiography along all lines of research, methodology and interpretation. There was a persistent and steady development of earlier trends in critique and technique, and a great improvement in the mechanical accessories to historical study such as bibliographical aids, guides to the sources, and in the gradual opening up of governmental archives. State aid to historical studies was awakened by the Romanticist and nationalist schools of historiography, especially where the break in tradition and continuous government made necessary the establishment of an artificial connection with the past. Thus the State was more generous on the continent of Europe than elsewhere in the early 19th century, aiding in the collection and publication of huge national source collections. Learned societies still further promoted historical studies by erecting a huge apparatus of value in historical research.

While with the tremendous increase of knowledge of the past historians tended constantly to great specialization and followed various schools of interpretation as causation became more fully understood; yet in all this diversity the critical canons of the scientific school became the predominant note. It is impossible to make a sharp classification of 19th century historians into various schools, as they most frequently exhibit several tendencies, though usually one interpretation stands out above the others.

Nationalistic Tendencies. The steady growth of a fervent nationalism in the 19th century led to the presentation of nationalist views by many historians, whose impartiality was warped by a glowing patriotism or who deliberately showed a bias in magnifying national glories and achievements. It caused an exaggerated emphasis on the race idea, a theory of the natural superiority of certain peoples such as the Aryans, or the Nordics. A distinctively national spirit was seen permeating the whole course of a people's history, even in spite of political diversity as in Germany. Nationalist teachings of history were an important factor in arousing national aspirations for unification, as in Germany and Italy, or for independence as in the Balkan countries and Poland. This feeling of nationalism was especially strong in the smaller nations which had been great in the past, but had become of minor importance under modern conditions. The outstanding representatives of this school of interpretation were such historians as Treitschke, Henri Martin, George Bancroft and Richard Green. Another group, best represented perhaps by Hallam and Macaulay, wrote history in order to prove political theories or in defense of certain political parties. A philosophical school attempted to find an underlying principle or law in the development of civilization, each one finding a different principle which seemed to be the governing force. In accepting this theory, historians ran the danger of being compelled to hunt constantly for confirmation of a pre-conceived hypothesis. The economic interpretation of history, begun by Heeren, Karl Marx and Engels, gained more and more adherents as the full effects of the Industrial Revolution were more clearly realized. The defect in this materialistic method of interpretation is that it tempts some economic historians to find only selfish motives

as the controlling factor in civilization. The theory of evolution in the biological sciences was of great importance to historical studies. The history of civilization was deemed to be an evolutionary process, the story of human adjustments to changing conditions.

Other historians laid emphasis on geographic and climatic influences on a people's development, and the controlling force of physical environment was substituted for the medieval theory of providential causation. In no field has there been more exaggeration of a single set of causes. In reality climate as a controlling factor decreases as civilization advances. Such a theory tends to destroy chauvinism, but on the other hand results in the flouting of many rules of critical methodology. National economic Imperialism had an opposite effect, however, for it tended to perpetuate and strengthen an already ardent nationalism and racial egoism.

The development of the social sciences in the late 19th century led to many new schools of interpretation, or to the renewal of emphasis on old theories. Sociological historians interpreted the past in the light of changing social conditions. Psychology affected history in that there were some historians who interpreted the past in terms of the changing attitudes of the intellectual classes. Anthropology and ethnology have been called to the aid of history in the endeavor to find laws of cultural development.

Of great importance was the extension of the theory of causation in the 19th century, which led to a consideration of a multitude of causes for each event. It is no longer possible to seize on certain schools of interpretation as representative of recent historiography. Instead, there is a tendency to fuse all of the various interpretations in a synthetic treatment of a purely objective nature.

Under the influence of geology and anthropology, there has been in recent years a more striking development in the new history. This has been a tremendous extension of the time element. Whereas historians formerly considered civilization as of 6,000 years duration, now it is customary to think in terms of many thousands or even millions of years. Consequently, there has been a tendency to go back to the writing of universal history. However, due to the extent to which specialization has been carried, it has been impossible for one man to write a scholarly account of the whole of civilization; instead one finds an ever increasing number of great cooperative works by eminent historians. A. P. W.

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HISTORY, ECONOMIC INTERPRETATION OF. *See* ECONOMIC INTERPRETATION OF HISTORY.

HITCHITI, a North American Indian tribe speaking a dialect of the Muskhogean stock. They formerly occupied a town called Hitchiti on the eastern bank of the Chattahoochee River, as well as part of its banks in western Georgia. They have been consolidated with the Creek Nation, though they retained their own language and customs.

HITLER, ADOLPH (1889-), Austrian political leader and founder of the National Socialist movement in Germany, was born on Apr. 29, 1889, at Branau-on-Inn in the Austrian Tyrol, the son of a customs official. A teacher seems to have influenced him as a boy, to great admiration for Germany and contempt for Austria-Hungary and its Habsburg Government. An orphan at 13, he left school to earn a living. He spent some time in Vienna, and then after eight years moved to Munich. In spite of his ambition to be an artist, he had to follow other trades. At the time the war broke out he was studying architecture. By fighting in the German army Hitler lost his Austrian citizenship without gaining that of Germany, and therefore had to live on a temporary police passport, a man without a country. He served in a Bavarian regiment 1914-18 and became a lance corporal and won the Iron Cross. He was gassed and lying in a hospital at the time of the Armistice. There he began to plan his political career.

In 1920 Hitler founded the National Socialist Party and its organ, the *Volkische Beobachter.* The group followed Fascist methods of organization in centuries and legions, and adopted a brown shirt and gray cap as costume, with the swastika as their emblem. Their platform demanded the overthrow of the Republic, the establishment of a dictatorship, the nationalization of industry but the retention of competitive labor, and opposition to Communists, Jews and aliens. By 1923 Hitler had 200,000 followers and together with Gen. Ludendorff, early in November, engineered an unsuccessful uprising (*putsch*) in Bavaria. After 10 months in prison he decided to follow legal methods. He made little use of printed propaganda, but by tireless energy, persuasive eloquence, and much personal magnetism, built up a party that polled a vote of about 6,500,000 at the elections of Sept. 14, 1930, making his party the second in number in the Reichstag. A series of successes in the following year increased still more his powerful following as well as his personal prestige. He was a candidate for President in 1932 but was defeated by Von Hindenburg. A. L. L.

HITOMARO, KALINOMOTO (d. 760), Japanese poet, was born in Japan at the beginning of the 8th century. Little is known of his life, except that he was of imperial descent, and became a provincial

officer, and later a court poet who accompanied the Mikado on his journeys through the provinces. The impulse to literature, following the first historic intercourse of Japan with Korea and China, reflected itself in Hitomaro's work, many examples of which can be found in that treasury of Japanese poetry, dated 760, and entitled *Manyoshu,* or the *Collection of a Myriad Leaves.* His poetry is often of an elegiac nature and is infected with a somber melancholy. He is generally considered one of the greatest masters of pure Japanese verse. Hitomaro died in 760. *See also* JAPANESE LITERATURE.

HITTITE, the conventional name given a language preserved in a large number of inscriptions throughout the area of the ancient Hittite Empire from northern Syria to the center of Asia Minor. They date from the 8th century B.C. onwards, and are written in about 180 hieroglyphic (*see* HIEROGLYPHS) characters, apparently syllabic, in lines running alternately from right to left and from left to right ("boustrophedon"). The inscriptions have thus far defied every effort to decipher them, and the nature of the language is quite unknown. The term Hittite or Pseudo-Hittite is likewise commonly applied to KANISIAN.

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HITTITE EMPIRE. The racial origin of the Hittites is uncertain; but recent decipherment of their inscriptions has definitely placed their language in the Indo-European family. Our first glimpse of them is obtained in the time of Sargon of Agade, about 2750 B.C., when they seem to have been divided into a number of city-states, or tribal areas, occupying the eastern half of Asia Minor. Subsequently, for purposes of mutual protection, they organized into a confederacy which was gradually fused into a single centralized nation ruled by the kings of Hatti, with the seat of government at Hattusas (Borghaz-Keui).

By the 15th century B.C., the Hittites were holding a position of major importance in the civilized world, serving as a formidable wedge between the rival powers of Egypt in the south, and Assyria and Babylonia in the east. About 1400 B.C., a remarkable ruler named Subbiluliuma ascended the throne of Hatti. By brilliant military exploits and wise alliances, this king forged a mighty Hittite empire that extended like a huge comma over all of Asia Minor, most of Syria and part of Palestine. He led a military expedition that swept down over northern Mesopotamia to the Orontes valley; established his suzerainty over Mittani, which lay between the Euphrates and the Tigris; and conquered all of northern Syria. The Amorites of central Syria acknowledged his overlordship, and aided him in campaigns against Phoenicia and Palestine. Although his conquests included provinces of Egypt, Subbiluliuma managed to maintain friendly relations with the pharaoh, Amenhotep III and his successor, Amenhotep IV, as the Tel el-Amarna letters prove. The empire founded and organized by him lasted for two centuries.

Subbiluliuma is the first of the Great Kings whose archives have been unearthed at Hattusas. War was the chief occupation of the Hattic emperors; but they also served as high-priests. Many of them proved themselves able administrators, making numerous advantageous alliances with neighboring countries. Although they were an intelligent and vigorous people, the Hittites had no time to create a culture distinctly their own; their arts, industries and religion were borrowed from surrounding civilizations. They were among the first to employ iron weapons and horse-drawn chariots in warfare, which gave them a tremendous advantage over less advanced states.

Wars with the Egyptians were frequent. In 1288 B.C., a great battle was fought at Kadesh on the Orontes between the Hittites and an Egyptian army under Rameses II, which ended indecisively. About 12 years later, a non-aggression treaty was concluded by Rameses and the Hittite king, Hattusil. But the Hittites were to face more formidable enemies than the Egyptians. The rising power of Assyria was constantly encroaching on its eastern frontiers. At the same time, invaders from the European mainland poured in from the north, overran Asia Minor, and forced the Hittites to migrate southward. Crushed between these two forces, the Hittite empire crumbled to pieces soon after 1200 B.C. For several centuries thereafter, the Hittites made a valiant fight to avert extinction, but they gradually weakened under the persistent assaults of their foes. Finally, about 707 B.C., they were utterly defeated by Sargon II of Assyria, who incorporated their land into his empire, and thus they disappeared from history.

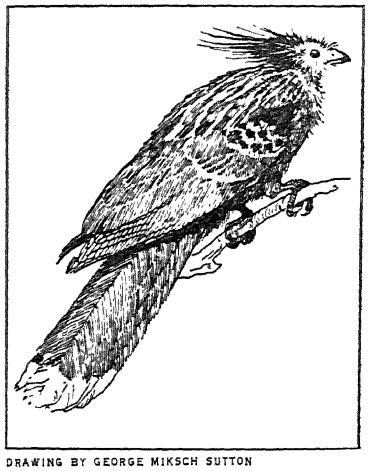
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HITTITES, the ancient inhabitants of Syria and Asia Minor, known variously as *Heth* in the Old Testament, *Kheta* by the Egyptians and *Khatti* by the Assyrians. From 1500 B.C. to about 1190 B.C. the Hittites appear to have formed a powerful nation, threatening the supremacy of Egypt. About 1758 B.C. they conquered Babylonia and ended the rule of the Amorites there. From about 1190 B.C. the power of the Hittites began to decline, until during Biblical times they fell an easy prey to the invading Hebrews. In the early years of the Hebrew monarchy they were either fast disappearing or intermarrying with the Hebrews. The most fascinating question in connection with the Hittites is the deciphering of the strange hieroglyphic inscriptions on the Hittite monuments and other pictographic antiquities unearthed in excavations on ancient Hittite soil. Much scholarly ingenuity has been expended in efforts to decipher the characters, the results tending to show that the language of the Hittites belongs in structure and form to the Indo-European group, and that they were probably of Indo-European social stock.

HITTORF, JOHANN WILHELM (1824-1914), German physicist, was born at Bonn, Mar. 27, 1824. In 1852 he became professor of physics at Münster.

He launched researches into problems of electrolysis and ion movement, which proved of importance in the development of chemistry. Experimenting with the passage of electric currents through rarefied gases he obtained a luminous effect, the origin of the modern neon lamp. He died at Münster, Nov. 28, 1914.

HOACTZIN (*Opisthocomus cristatus*), a curious fowl-like bird somewhat resembling a slender pheasant found from Colombia to Bolivia. It is about 2 ft. long, with a crested head, rounded wings and a



DRAWING BY GEORGE MIKSCH SUTTON

HOACTZIN

long tail. In color its plumage is olive and brown above and buff below, the tail tipped with yellow. Going in small companies, the hoactzin frequents the dense growth along lakes and streams, nesting in bushes near the water and laying 2 or 3 reddish-spotted, yellow eggs. It feeds upon leaves and fruits chiefly of an arum which are crushed in a muscular crop. The young are remarkable in having clawed fingers on their wings by means of which they are able to climb about in trees like quadrupeds.

HOAR, GEORGE FRISBIE (1826-1904), American statesman, was born at Concord, Mass., Aug. 29, 1826. He attended Concord Academy and graduated from Harvard University in 1846 and from the Dane Law School at Harvard in 1849. He was admitted to the bar the same year and began practice at Worcester, Mass. An opponent of slavery extension, he affiliated himself with the Free Soil party, which he represented in 1852 in the Massachusetts house of representatives. As a member of the new Republican party which he helped to organize in Massachusetts, he served in the state senate, 1857.

In 1868 Hoar was elected as a Republican to the national House of Representatives and was thrice reelected, serving from Mar. 4, 1869 to Mar. 3, 1877. He was not a candidate for renomination in 1876. He was one of the managers appointed by the House of Representatives in 1876 to conduct the impeachment proceedings against William W. Belknap, former Secretary of War. In 1877 he was one of five representatives who were appointed to the electoral commission to decide the contests in Oregon, South Carolina, Florida and Louisiana in the Hayes-Tilden disputed election of 1876. He was elected to the U.S. Senate and was four times reelected, serving from Mar. 4, 1877 until his death.

Hoar was recognized as one of the Republican leaders in his native state and in the nation. He presided over the Massachusetts state Republican conventions in 1871, 1877, 1882 and 1885. He was a delegate to the Republican national conventions in 1876, 1880, 1884 and 1888. He presided over the convention of 1880 and was chairman of the Massachusetts delegation in 1880, 1884 and 1888. Hoar continued an interest in intellectual enterprises with his political activities, serving as overseer of Harvard University 1874-80 and again from 1896 until his death, and in 1880 he was a regent of the Smithsonian Institution. His *Autobiography of Seventy Years,* which was published in two volumes in 1904, is a source rich in information of the politics and politicians of the second half of the 19th century. He died in Worcester, Mass., Sept. 30, 1904.

HOAR FROST, a very fine coating of ice deposited upon leaves and other objects near the ground at times when the temperature of the air is so low that instead of DEW, FROST is formed.

HOBART, GARRET AUGUSTUS (1844-99), Vice-President of the United States, was born at Long Branch, N.J., on June 3, 1844. He was graduated from Rutgers College in 1863, was admitted to the bar in 1869 and practiced law at Paterson, N.J., where he became an influential politician. He was solicitor for the city of Paterson in 1871, and a member of the state legislature for eight years, including service in the Assembly from 1873-75 and in the Senate from 1877-83. He was the presiding officer in both houses. In four successive Republican National Conventions, he was delegate-at-large from New Jersey. He was elected Vice-President of the United States in 1896 under McKinley. He died, while in office, at Paterson, N.J., on Nov. 21, 1899.

HOBART, the capital of Tasmania, Australia, well situated on the western shore of the Derwent River, about 12 mi. from the sea; and within the shadow of Mount Wellington. The harbor is deep and well-sheltered. Although the city is in many respects old fashioned, it has some fine modern public buildings, including the Parliament Buildings and city hall. The University of Tasmania, established in 1889, is a small but creditable institution. The city's industries include woolen mills, sawmills and tanneries. Pop. 1921, 52,163; 1929 est., 56,696.

HOBART, a city in Lake Co., northwestern Indiana, situated on the Deep River, seven mi. southeast of Gary. Two railroads serve the city. There is an emergency landing field. Hobart is in a region devoted to farming and dairying. The chief local industries are the manufacture of tiles and terra cotta. The city was founded in 1840. Several miles northeast of Hobart is Indiana Dunes State Park. Pop. 1920, 3,450; 1930, 5,787.

HOBART, a city in southwestern Oklahoma, the county seat of Kiowa Co. It is situated near Big and Little Elk rivers, 55 mi. west of Anadarko. Two railroads serve the city. Hobart is a trade center for alfalfa, grain and cotton, and has cotton gins and compresses, cold storage plants and alfalfa and cotton-seed-oil mills. In 1901 this site was opened for white settlement, by the United States government. Pop. 1920, 2,936; 1930, 4,982.

HOBART COLLEGE, at Geneva, N.Y., a privately controlled college for men, having a coordinate department for women known as William Smith College. It is affiliated with the Protestant Episcopal Church. Founded in 1822, it was first named Geneva College, then Hobart Free College, and in 1860 Hobart College. The productive funds in 1931 were $1,156,664. The library contained 90,000 volumes. In 1931-32 there were 320 students and a faculty of 43, headed by Pres. Murray Bartlett.

HOBBEMA, MEYNDERT (1638-1709), Dutch landscape painter, was born at Amsterdam, Oct. 31, 1638. He probably studied under Ruisdael. All of Hobbema's work was done during the first 30 years of his life, after which time he married the cook of the Burgomaster of Amsterdam and devoted his energy to his duties as official wine gauger. His masterpiece, *The Avenue, Middelharnis,* in the National Gallery, London, is one of the best known landscapes in the world. Although Hobbema lacks the range of Ruisdael, his ability to manipulate cloud and light effects and the sympathy with which he interprets nature place him among the foremost Dutch artists. He died at Amsterdam in 1709.

HOBBES, THOMAS (1588-1679), English philosopher and mathematician, was born at Malmesbury, Wiltshire, Apr. 5, 1588. He studied at Oxford and in 1608 became the tutor of Lord Cavendish, in which capacity he made several visits to the Continent. His connection with the Cavendish family brought him into close relationship with the Stuarts, whom he tried to defend in his best known work, *The Leviathan,* 1651. Among his other works are the *De Corpore,* 1655, and the *De Homine,* 1658. Hobbes' interest in mathematics led him to adopt a rationalistic method of procedure. Metaphysically he was a materialist and ethically a hedonist. Hobbes occupies an important position in modern thought. Materialism develops from him and idealism as a reaction against him. Revolting against his selfish system of ethics spring the moral sense and rational intuitionist schools. He died at Hardwick Hall, Dec. 4, 1679.

HOBBING MACHINES. Machines for cutting gears by the hobbing method. *See* GEAR CUTTING MACHINES; *also* MACHINE TOOLS. The term hobbing is also used in connection with a process of forcing a depression into a steel die by means of heavy pressure on a steel punch or form of the proper shape. This formed punch is called a hob. In some places the term hub is used instead of hob and the operation is then known as hubbing.

HOBO, a term for the American variant of the homeless, migratory man. Being essentially a worker, he differs from the sturdy beggar and the vagrant tramp. His labor is an important factor in such seasonal work as harvesting, fruit picking, sheep shearing, road and railroad building, lumbering and fishing. His chief means of transit is the railroad. At times young hobos, some of them women, have taken to migrating, or hitch-hiking, along automobile roads. Estimates on the number of hobos in the United States vary from 500,000 to 2,000,000. The median age is about 35. About 10% are under 20 and the same proportion over 60 years; 60% are American by birth; about 15% have been or are married; and few are skilled workers. Most hobos come from poor or lower middle-class urban homes. When he becomes unemployable, the hobo may become a city beggar or tramp, but rarely a criminal. Many hobos, however, adopt some settled pursuit before age overtakes them. When jobs are few the hobo takes his place in the city breadlines beside the common vagrants and regular workers temporarily unemployed. N. A.

BIBLIOGRAPHY.—N. Anderson, *The Hobo;* G. Milburn, *The Hobo's Hornbook.*

HOBOKEN, a city of Hudson Co., N.J., situated on a level site between the Palisades and the Hudson River, adjoining Jersey City on the north and facing New York City with which it is connected by Rapid Transit tubes and ferries. It is the eastern terminus of the Lackwanna Railroad and is connected with all the various railroad lines entering the Metropolitan district. Along its waterfront are located many great piers and docks, among which are numbered those of the Holland-American, Munson, Lamport and Holt, and United States lines. Its industries include warehousing, ship repairing and the production of leather goods, various kinds of electrical equipment, baking powder and pencils. In 1929 its manufactures were valued at approximately $75,000,000; the retail trade amounted to $24,319,025. Hoboken is the seat of STEVENS INSTITUTE OF TECHNOLOGY, named in honor of John Stevens (1749-1838), who laid out the town in 1804. Adjoining the college grounds, built on a rare rock formation, is Castle Point, a historic landmark, now part of Hudson Park. HENRY HUDSON landed at what is now Hoboken, and the site was purchased from the Indians by the Dutch in 1630. The name Hoboken is derived from an Indian word Hobocan, meaning tobacco-pipe. Among the prominent residents have been numbered John Jacob Astor, General George B. McClellan and Hetty Green. Hoboken was founded by the Dutch in 1630 and received its charter and as a city in 1855. Pop. 1920, 68,166; 1930, 59,261.

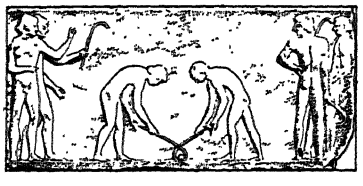
HOBSON'S CHOICE, a term meaning "this or nothing." The expression originated in the following manner: the chief livery stable in Cambridge, England, was kept by one Thomas Hobson (1544-1630), an eccentric man who, in renting out his horses to customers, always followed an exact rule. "You may have your choice, sir," he would say, but

the customer had always to take the horse nearest the stable door. JOHN MILTON wrote two epigrams on Hobson, who also appears in *The Spectator,* Oct. 14, 1712.

HOCHE, LAZARE (1768-97), French general, was born near Versailles, June 24, 1768. At 16 he entered military service and was steadily promoted until in 1793 he became general of a division in the Republican army. That year he expelled the Austrians from Alsace and in 1794-95, during the Reign of Terror, suppressed a Royalist revolt in La Vendée. In 1796 he headed an attempt to invade Ireland, but his expedition was impeded by continued inclement weather. As commander of the army of the Sambre and Meuse in 1797, he won several victories over the Austrians. He died at Wetzlar, Sept. 19, 1797.

HOCHELAGA, in the Indians' North America, one of the four kingdoms of the St. Lawrence region, and the capital city of that division. The four divisions were: the Gaspe Peninsula, Honguedo; from the Gulf of St. Lawrence to the Isle aux Coudras, Saguenay; from that island to a point several miles west of Quebec, Canada; thence to the Lachine Rapids, Hochelaga. JACQUES CARTIER on his second voyage visited the capital city of Hochelaga, Oct. 1535. The place, strongly fortified by triple palisades and enclosing about 50 group dwellings, lay between the present business district of Montreal and the foot of Mt. Royal. The inhabitants were of Iroquoian stock.

HOCKEY, a game played on ice or field with a ball and stick with a curved end. The origin of the game is a matter of dispute. Some maintain it was developed from America's oldest organized sport, lacrosse. When the white men adapted the ancient Indian game to the ice, they reduced the number of players on a team from 20 to 7, cut the size of the playing field in half, flattened the hard rubber ball into a disc, called a puck, and reshaped the stick after removing the rawhide stringing. The name of the players' positions remain unchanged, being goal, right and left defense, center forward and right and left wing. Unfortunately for this argument the playing positions in a hockey game differ little from those observed in other field games of ancient origin, such as the various forms of football: soccer, rugby and gaelic. Then there is shinny, which is practically the same as hockey, played without the employment of skates and lacking the modern refinements of technique and rules. Perhaps it would be closer to the truth to assert that hockey is merely an adaptation of football, shinny, or similar mass games in which the purpose is the propulsion of a ball or other object towards a given objective or goal. The basic structure of such games must be as old as history.



AS THE GREEKS PLAYED HOCKEY
Relief showing players ready to "bully off," with sticks reversed

While Canada has adapted hockey to ice, the game has a wide vogue in countries where frigid temperatures are known but little if at all. In field hockey, played with a ball instead of a flat disc, there are 11 players on a side, the alignment being similar to that in association football: goal, right and left back, right, center, and left half back and five forwards, outside and inside right, center, inside and outside left. Obviously it is difficult to procure an ice surface of sufficient area for the operation of two elevens; hence the restriction of the modern ice hockey team to six players. Formerly a side included a rover; but seven-a-side hockey was dropped several years ago.

Often referred to as Canada's national sport, ice hockey has made great strides in the United States within the last few years following the extension of the major professional league, called the National Hockey League, to embrace New York, Chicago, Boston and Detroit. New York supports two teams, the Rangers and Americans. Philadelphia in 1930 was included in the N.H.L., having taken over the franchise of Pittsburgh where the game was less successful. Canada gives four teams to this league; Ottawa and Toronto have one each, and Montreal two. Other leagues are maintained in the East and West. The introduction and success of the professional game has added an impetus to the playing of the game among amateurs and especially in colleges, with Yale, Harvard, Princeton and Dartmouth featuring in the latter category.

Hockey Contests. The first real hockey contest is said to have been played in Kingston, Ont., in 1888, although a nondescript shinny-lacrosse game was held at McGill University, Montreal, as long ago as 1879, a student of McGill being credited with producing the first puck. Most goal-to-goal games played in Europe were in a highly developed state long before these dates, while even field hockey can claim to have been organized in England as long ago as the '60s.

Madison Square Garden in New York City furnishes a striking illustration of what modern refrigeration engineering has accomplished in the establishment of hockey as an indoor sporting entertainment. Beneath an area of terrazzo floor, 85 by 186 feet, there are 12 miles of pipes through which cooled brine is circulated. By spraying the floor above with water an ice surface one inch thick can be provided in six hours.

The Stanley Cup, named after Lord Stanley, formerly Governor General of Canada, the donor, is the coveted prize in professional hockey. The trophy was won in 1931 by Les Canadiens of Montreal. In these cup games and also the more attractive league contests, crowds sometimes gather to the number of 15,000 or 18,000.

The duration of an ice hockey game is 60 minutes, consisting of three 20-minute periods. In field hockey

the time consumed is similar to that in soccer, two periods of 45 minutes each. The pitch for field hockey is approximately 100 yards by 50 or 60 yards, the goal being 12 feet wide and 7 feet high. While no specified measurements govern the size of the playing surface for ice hockey, the area, roughly, is about one-half that required for the field game. The ice hockey goal is proportionately smaller. K. N. P.

HODGKIN, THOMAS (1831-1913), British historian, was born in London on July 29, 1831. He took his degree at London University, and entered the banking firm of Hodgkin, Barnett & Co., later absorbed by Lloyds Bank. By devoting a good deal of time to historical study he succeeded in steeping himself in early medieval history. He wrote on religious subjects from the Quaker viewpoint. His published works include *Italy and Her Invaders,* 1880-99; *The Dynasty of Theodosius,* 1889; *Life of Charles the Great,* 1897; *Life of George Fox,* 1896; and the first volume of Longman's *Political History of England,* 1906. His books, especially the eight-volume work on *Italy and Her Invaders,* are characterized by a vivid style.

HODGKIN'S DISEASE, a disease which affects the lymphoid tissues of the body, with the development of characteristic cells in a more or less characteristic arrangement. *See* LYMPHATIC SYSTEM, DISEASES OF.

HÓDMEZÖ-VÁSÁRHELY, a city in the Hungarian province of Csongrad, in a rich, thickly populated district and protected by large dikes against the highwater of the Tisza River. The city has schools and a theater; it carries on extensive farming, cattle raising and horse breeding. Hódmezö-Vásárhely trades in agricultural products and manufactures sugar and decorative earthenware. Destroyed by the Turks in 1693, it was deserted by the citizens, but was settled again six years later. Pop. 1930, 60,176.

HOE, RICHARD MARCH (1812-1886), inventor and builder of printing presses, was born Sept. 12, 1812, in New York City. At an early age he became interested in printing, and ultimately joined his father's company, Robert Hoe & Co., New York. In 1846 he completed a printing press with revolving type cylinders, familiarly known as Hoe's lightning press. This was the first rotary press and it subsequently came into general use for printing newspapers. Another Hoe press printed on both sides of the sheet at the same time and had attached mechanism for cutting and folding. Hoe was a collector of manuscripts and the author of several books and articles. Hoe died June 7, 1886, at Florence, Italy.

HOF, an old Bavarian city on the Saale River. It is the center of the Upper Franconian textile industry. The other industries of the city include machine manufacture and brewing. It has trade in grain. The rathaus of 1566 has been completely changed by rebuilding. Opposite it is St. Michael's Church, built in 1230 and restored in 1826. Pop. 1925, 41,377.

HOFER, ANDREAS (1767-1810), Tirolean patriot leader, was born in the Passeier Valley, Nov. 22, 1767. He became a captain in the militia and after the peace of Pressburg led the rising of the Tirolese in 1809. He was victorious over the Bavarian allies of France at Sterzing and at Innsbruck in the War of Liberation, forcing them to retire from Tirol, and also over the armies of Napoleon sent in July, but in a third invasion by the combined armies Hofer was obliged to hide himself. On Jan. 28, 1810 he was betrayed into the hands of the French and shot at Mantua.

HÖFFDING, HAROLD (1843-1931), Danish philosopher was born at Copenhagen in 1843. In 1871 he became an instructor in the University of Copenhagen and in 1883 was advanced to a professorship in philosophy. He died at Copenhagen, July 2, 1931. His chief works translated into English are: *History of Modern Philosophy,* 2 vols., 1900; *Philosophy of Religion,* 1906, and *The Problems of Philosophy,* 1915. Following IMMANUEL KANT, Höffding shows that the historical arguments for the existence of God prove nothing for religion. In its relation to science religion seeks the universal cause of all phenomena, science the particular cause of special phenomena. Inscribing a circle of existence, religion would trace all events to the center of the circle, while science is interested only in establishing connections between events on its periphery. Science takes as its axiom the conservation of energy; religion takes as its axiom the conservation of value.

HOFFMAN, ERNST THEODOR AMADEUS (1776-1822), German novelist, was born at Königsberg, Prussia, Jan. 24, 1776. He adopted the name of Amadeus instead of Wilhelm as a tribute to Mozart. In the course of an irregular, intemperate life, he studied law, and became a councilor at the Supreme Court of Posen only to be dismissed because of an insulting caricature. He then lived in Warsaw as musical conductor and scene painter, and after considerable literary activity ended as judge of a criminal court in Berlin from 1816-22. Hoffman wrote of haunted houses and mesmerism, devils and mental disease. Ghosts and horrors permeate his stories, among which are *The Devil's Elixir,* 1816, *Night Pieces,* 1817, *Fantastic Pieces in Callot's Manner, Brothers of Serapion* and *Kater-Murr,* 1821-22. He was a master of the uncanny, and his "Gothic" tales of terror may have been influenced by Lewis's *Monk.* (*See also* LEWIS, MATTHEW GREGORY.) His tales had considerable vogue in France, and may quite well have stimulated EDGAR ALLAN POE. The decadent element in Romanticism here finds expression; but nevertheless Hoffman was also a master of realistic description and psychological analysis. He died in Berlin, July 24, 1822.

HOFFMAN, MALVINA (1887-), American sculptor, was born in New York, June 15, 1887. She studied painting with John Alexander, and sculpture with HERBERT ADAMS and GUTZON BORGLUM in New York, and with AUGUSTE RODIN in Paris. Her *Russian Dancers* won first prize in Paris in 1911, and since then she has received many awards. She is an

associate of the National Academy. In 1924 she married Samuel B. Grimson. Her works include *John Muir,* American Museum of Natural History; *Modern Crusader,* Metropolitan Museum; memorial group, *The Sacrifice,* Cathedral of St. John the Divine until it goes to Harvard University; *Ignace Paderewski, the Artist,* portrait, Academy of Rome; *Ignace Paderewski, the Statesman; Pavlowa Gavotte,* Museum at Stockholm; and *Bill,* Luxemburg Museum, Paris.

HOFFMANN, LUDWIG (1852-), German architect, was born at Darmstadt July 31, 1852. He studied at Kassel and Berlin and his first important design was that of the Court House at Leipzig. A year later, in 1896, he became city architect of Berlin, a post which he retained until 1924, superintending the bulk of the construction of the modern metropolis and himself designing many school, public, and industrial buildings and most of the city's bridges. The new Museum was built under his direction.

HOFMANN, AUGUST WILHELM VON (1818-92), German chemist, was born at Giessen, Apr. 8, 1818. In 1853 he became associated with the Royal School of Mines at London, and in 1861 president of the London Chemical Society. In 1863 he returned to Berlin, founded a chemical laboratory and organized the German Chemical Society. He was ennobled in 1888. Hofmann devoted most of his attention to problems of organic chemistry, analysing many organic bases. His work on coal tar derivatives practically founded the modern dye industry. He was likewise an eminent and influential teacher. He died at Berlin, May 5, 1892.

HOFMANN, JOSEF (1876-), Austrian pianist and composer, was born at Cracow, Poland, Jan. 20, 1876. In 1883 he began studies with RUBINSTEIN. After successful European appearances, he visited the United States in 1887, beginning a tour which ended when objections were raised by the Society for the Prevention of Cruelty to Children. Additional studies in Europe were followed by concert tours in many countries. Hofmann was appointed director of the Curtis Institute of Music, Philadelphia, Pa., in 1927. He has composed concertos, piano pieces, a symphony and an orchestral suite, and has written articles and two textbooks on piano technique.

HOFMANNSTHAL, HUGO VON (1874-), Austrian poet and dramatist, was born in Vienna, Feb. 1, 1874, and educated at the University of Vienna. His adolescent poetry of the late 90's created a furore in literary circles by its studied return to romanticism. Later dramas, also of a neo-romantic type, exemplified his unique gift for reviving and revitalizing ancient cultures through dramatic channels. Hofmannsthal while regarded as the leading exponent of German neo-romanticism abandoned the past in later writings and turned to light, satirical social comedies. Examples of his work are *Gestern,* 1891, *Oedipus und die Sphinx,* 1906; *Die Frau ohne Schatten,* 1919, and *Die Unbestechliche,* 1923. RICHARD STRAUSS created musical versions of some of his plays and thus added immensely to Hofmannsthal's international reputation.

HOFMEYER, JAN HENDRIK (1845-1909), South African public official, was born at Cape Town, July 4, 1845. He was educated at the South African College. He obtained control of the Farmers Association and the Afrikander Bond, and by so doing became leader of the Dutch residents of Cape Colony and from 1879 to 1895 served in the Cape parliament. After the Boer war in 1909 he was sent to London as a delegate to complete arrangements for the South African Union, where he died, Oct. 16, 1909.

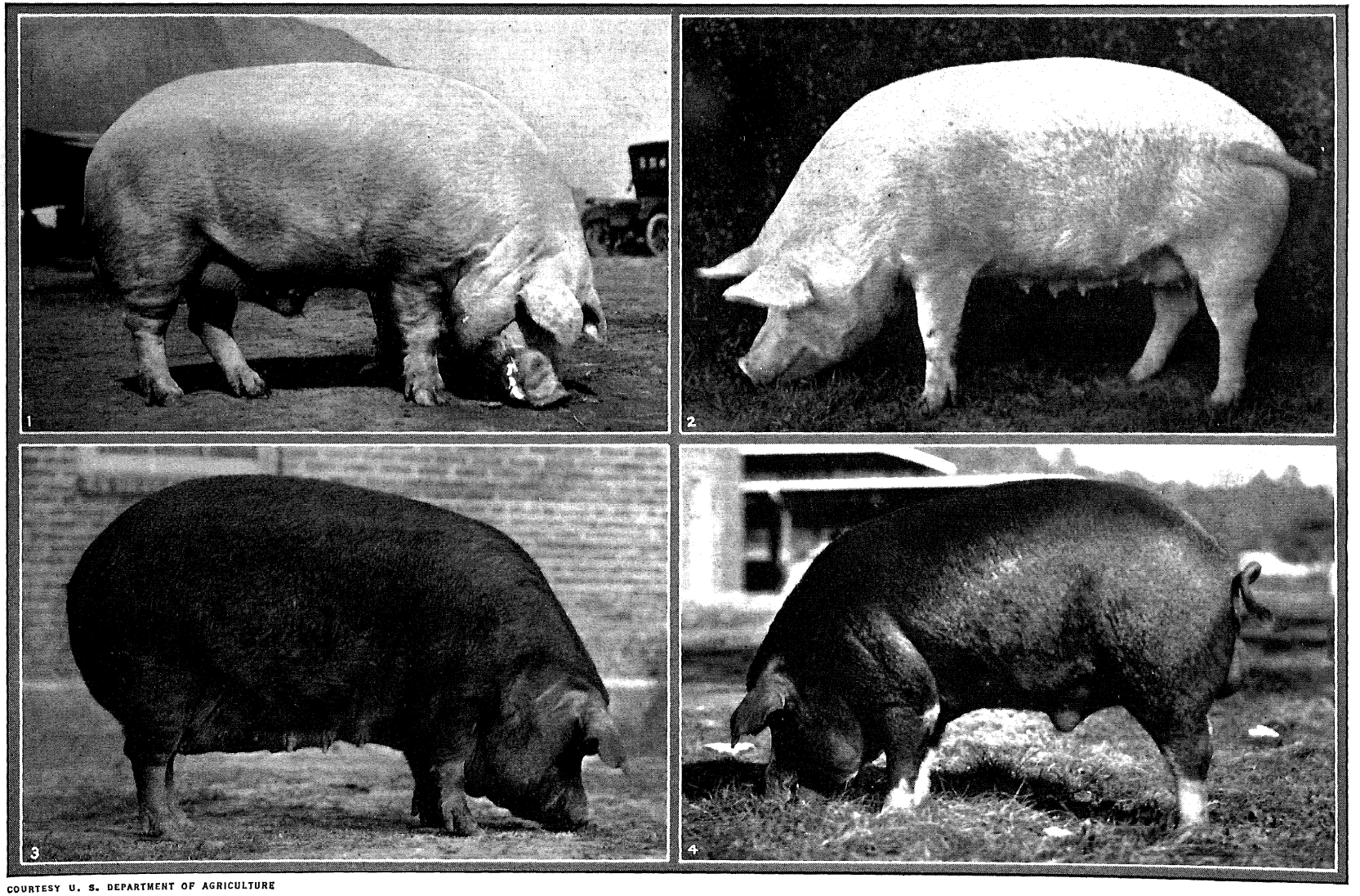
HOGARTH, WILLIAM (1697-1764), English artist, was born in London, Nov. 10, 1697. He began his career as an engraver and made his reputation with the three moral series, *A Harlot's Progress,* 1731, *A Rake's Progress,* 1735, and *Marriage à la Mode,* 1745. In these Hogarth wished to be regarded as "author" rather than "artist" and gave his purpose to be "the composition of pictures on canvas, similar to representations on the stage." In them he revealed himself as the good-natured, robust satirist of a rowdy age. In his paintings, which met with little notice during his lifetime, he showed a technique which was more allied with the French Impressionists than with the English 18th century masters. *The Shrimp Girl* in the National Gallery, London, is probably his masterpiece. Hogarth died in London, Oct. 26, 1764.

HOG CHOLERA, a disease of swine caused by *Bacillus cholerae suis,* and characterized by continuous fever, ulceration of the intestines and skin discolorations, especially around the pubic regions. The disease is widely spread throughout the United States and Canada; in Great Britain, it is called swine fever. It also exists in Europe and Central America.

The period of incubation is 7 to 14 days, and the disease may take the acute, mild or chronic form, with differing symptoms. In acute cases, the animal dies after a few hours. Other forms run a longer and less severe course. The animals appear dumpish and spiritless, huddle together and are oblivious to attention. There may be diarrhoea or constipation, and sometimes a cough. Reddening, sometimes very marked, occurs around the features and ventral surfaces. Postmortems show that lesions in the acute form are hemorrhagic or septicemic. The chronic form is more common, the lesions usually being limited to the larger intestine, spleen, liver, kidneys and lymphatics. The prognosis is unfavorable. The differentiation of hog cholera from swine plague is that of specific bacteria. Thorough disinfection of the premises after affected animals are killed or die is imperative.

HOG FUEL, or hogged fuel, wood refuse, logs, mill ends, slabs, edgings, trimmings and the like, macerated or reduced to a uniform size. Hogging is done by chipping, chopping with revolving knives or hammering. The term "hog fuel" is sometimes used to designate sawdust, shavings, chips and other small wood wastes used as fuel.

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COURTESY U. S. DEPARTMENT OF AGRICULTURE

IMPORTANT BREEDS OF SWINE: PRIZE-WINNING TYPES

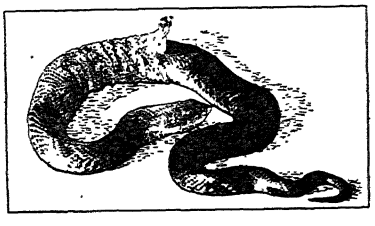
1. A pure-bred Chester White boar. **2.** A pedigreed Yorkshire sow.
3. Senior and grand champion Duroc-Jersey sow. **4.** Junior and grand champion Poland-China boar pig.

HOGG, JAMES (1770-1835), Scottish poet called The Ettrick Shepherd, was born at Ettrick, Selkirkshire, and baptised Dec. 9, 1770. He was a shepherd in his youth, and wrote songs for country girls to sing. He spent some years in Edinburgh in the society of leading writers, and figures prominently in the *Noctes Ambrosianae* of Christopher North. Then, in 1817, he settled on a farm at Altrive. As a lyrist of Scotland Hogg ranks next to ROBERT BURNS. Among his volumes are *The Mountain Bard, The Queen's Wake* and *The Shepherd's Calendar*. He died at Altrive, Nov. 21, 1835.

HOG HOUSES, buildings specially adapted to housing swine. Two types of farrowing houses are general: the central house, for a number of sows, extending lengthwise east and west, with doors from the pens to individual lots on the south; and the individual house about 7 ft. by 7 ft. either "A"-shaped or rectangular, the latter having a gable roof. In cold climates the houses should be low, warmly built, have windows arranged to direct sunshine on the pens during the farrowing season and have chimneys for heaters. Fattening hogs require no special type of building. However, their quarters must be dry, well ventilated and reasonably warm. T. A. H. M.

BIBLIOGRAPHY.—Farmers' Bulletin 1487, *Practical Hog Houses.*

HOG-NOSED SNAKE, called also spreading adder, any one of the four species of the colubrine genus *Heterodon*. These snakes, distributed over northern Mexico and most of the United States, are characterized by their thick-set bodies, spotted patterns and turned-up snouts. They have acquired a bad name because of their habit of flattening the neck and body as well as hissing and striking when



HOG-NOSED SNAKE SHEDDING SKIN

annoyed. This display invariably suggests a dangerous creature, whereas, in reality, the hog-nosed snakes are entirely incapable of inflicting even a slight wound. Close observation shows that they do not actually bite but are entirely satisfied to perform in a fear-inspiring manner. The hog-nosed snakes subsist largely on toads and reproduce by laying eggs. They are slow in their movements.

HOG PEANUT (*Amphicarpa monoica*), a low, slender, twining perennial of the pea family, called also American liquorice. It is native to moist thickets from New Brunswick to Manitoba and southward to Florida and Louisiana. The climbing, sparingly branched stem, usually a few feet long, bears numerous leaves of three leaflets and two kinds of flowers. Those borne on the upper branches are showy but sterile; the inconspicuous ones borne on threadlike stalks near the base produce underground pods containing a single edible seed.

HOG PLUM (*Spondias Mombin*), a graceful tree of the cashew family, called also yellow mombin. It is found throughout tropical regions and is extensively planted for its edible fruit. The tree grows about 60 ft. high bearing large leaves of many leaflets clustered near the ends of the branches, numerous long panicles of yellowish-white flowers and yellow, egg-shaped, fleshy drupes with a large stone. The fruit is a common food for hogs in the West Indies.

HOG RAISING. Although the wild progenitor of the modern domestic hog is not positively known, it is believed to be the wild boar (*Sus scrofa*) of western Asia, adjacent Africa and Europe. It is, however, probable also that in the remote past an East Indian species (*Sus cristatus*) was linked in the evolution. Related species are the wart hog of South Africa, the baribussa of East India and the peccary of South America, Mexico, Arizona and Texas. Apparently none of these animals has been domesticated, but they all become tame and breed freely in confinement.

Original domestication probably took place in the Orient but the hog is so useful, fecund, adaptable and amenable that it has accompanied the progress of man throughout the world. Nevertheless it was not used as food by some of the peoples that raised it; notably the Jews, Mohammedans and Egyptians, although the priests of the last did so use it or even permit others to do so on special feast days. In mild climates it often returns to the wild state but rapidly degenerates from the ideals of agriculture, as well evidenced by the razor back hogs of the Southern States.

Domestication and breeding have so profoundly modified the hog that resemblance to its wild ancestor is not apparent. Its wildness has been replaced by docility, though old boars often become treacherously vicious. Development is evident in change of form, color, size and ability to lay on flesh. The last is often so marked that animals almost lose the ability to move about and their legs are taxed to support their bodies. Wild boars sometimes weigh 250 lbs., mostly muscle and bone, and mature domestic fat hogs often reach 900 lbs. Such weights, however, are not desired because the market demand is less for fat pork and more for lean hams and bacon.

In England the popular generic term "pig" is applied to all animals of this species; in America "hog" is most used. Swine is also an exact synonym. Several other terms are in general use; namely, "boar" for the male; "sow" for the mature or bred female; "gilt" for the young female; "shote" or "shoat" for the young weaned animal of either sex; and "barrow" for a castrated male. Females are rarely spayed.

Hog raising is popular in almost every civilized country, but in many cases it is merely the rearing of sufficient pigs to utilize what would otherwise be waste materials. In the neighborhood of small cities, towns and villages these consist of table and kitchen

scraps, vegetable parings and the like from hotels, restaurants and residences. These usually cost nothing except for hauling; they have high feeding value and when fed while fresh are above reproach. Often they are supplemented with skimmed milk, buttermilk or whey which when produced in a small way on farms might otherwise be wasted. Such feed, coupled with free range during summer and access to forage and ample water, favors health and develops animals that fatten well on grain rations fed in confinement for a few weeks prior to slaughtering.

In many farming sections, especially in the United States, Canada, Denmark and Ireland, hog raising is a specialty industry. This is particularly true of the dairy sections where the by-products of creameries and cheese factories, such as skimmed milk, buttermilk and whey, are used to excellent advantage. It is also popular where cattle are fed, the hogs being counted upon to utilize corn which passes through the cattle undigested.

Hogs do not perspire as do horses or humans but wallow in mud and water to cool their bodies and rid themselves of external parasites. Wallows are therefore generally reckoned essential to successful hog raising, especially in warm and dry climates. In milder districts forests, woodlots or even groves are considered good substitutes. This habit has given rise to the belief that hogs are foul in their habits. This is not so. It is the dirty man who makes the dirty hog! Given reasonable opportunity hogs will keep their quarters as clean as those of any other animal allowed equal opportunity. Modern piggeries built upon this principle are easily kept clean and sanitary because of the cooperation of the animals themselves.

Although several classifications have been proposed, none is fully satisfactory. One is based on size of animal. In this the large breeds are Chester White, Large Yorkshire and Tamworth; medium breeds, Berkshire, Cheshire, Duroc-Jersey, Hampshire, Poland-China and Victoria; small breeds, Essex, Small Yorkshire and Suffolk. The classification most generally followed is based on the use to be made of the animals in the production of bacon or lard. The main objection to this is that some breeds are good for both lard and bacon. American lard or fat hog breeds include Berkshire, Cheshire, Chester White, Duroc-Jersey, Essex, Poland-China, Small Yorkshire, Suffolk and Victoria. The bacon breeds are Large Yorkshire and Tamworth.

The ideal bacon hog weighs 180 to 190 lbs. Its development is largely a matter of favorable climate and control of food, although market requirements are also influential. Canada and the dairy sections of northeastern United States produce excellent bacon profitably, partly because bacon-producing foods in these sections cost less to grow than do those needed for lard hogs and also because the market is better for this type of animal. Canada is the leader in the business, most of her bacon being marketed in England. Ireland and Denmark are also large producers.

The corn belt of the United States provides ideal conditions for the production of lard hogs because corn is cheaply grown and when properly fed makes firm, fine quality pork. As corn is rich in starchy material it must be balanced with protein feeds. Corn, however, is often fed to excess with the result that the animals suffer in digestion and make poorer pork.

HOGS ON FARMS, U.S.

5-Year Average, 1927-31

Division	*Val. per Head*	*Number*	*% of Total*
UNITED STATES	$13.78	55,675,000	100.0
LEADING STATES:			
Iowa	15.78	10,358,000	18.6
Nebraska	16.06	5,128,000	9.2
Illinois	14.68	4,584,000	8.2
Missouri	12.18	3,985,000	7.2
Minnesota	16.32	3,750,000	6.7
Indiana	13.44	2,879,000	5.2
South Dakota	15.90	2,771,000	5.0
Kansas	13.52	2,637,000	4.7
Ohio	12.68	2,267,000	4.1

To be profitable hogs fed to produce lean bacon must command 10% or more than the market price, but this advance is readily paid by the discriminating British markets. On the other hand, animals fed for fatness often command higher prices than do bacon hogs raised there, not because of the demand for lard but for the thick, heavy, fat, side meat which is sold as salt pork. So-called "Danish bacon" is largely produced in Canada, partly as the result of breeding and selection, partly because of feeding and exercise. Long-bodied, lean, preferably white, sows are selected as dams. Pork packing companies provide the ideal type of boars, usually of medium or large Yorkshire breeds. After weaning, the young pigs are allowed to run about until within six weeks or two months of marketing to prevent their developing too much fat. Their feed consists of ground barley and rye soaked over night, boiled potatoes and raw turnips, all of which are produced in perfection in Canada. They also get skimmed milk, buttermilk, grass in summer and root crops such as turnips, mangels or carrots, in winter. When slaughtered at 180 to 225 lbs. they have long, plump but not over-fat, well-developed, lean hams and thick straight bellies which make high-grade bacon. M. G. K.

HOGSHEAD, a measure of capacity equivalent to 63 gals. of 231 cu. in., the equivalent of two ordinary BARRELS. It was adopted from the old English hogshead of 63 wine gallons. It is used in measuring liquids and such commodities as salt, sugar, molasses and tobacco. The hogshead, like the barrel, is usually labeled with the weight of the commodity contained in it.

HOH, now living on a Reservation of the same name, the Hoh are a band of the North American Indian Quileute, of the Chimakuan stock, and now number less than 100.

HOHENLINDEN, BATTLE OF, Dec. 3, 1800, an engagement fought in Germany during the wars of the FRENCH REVOLUTION, between the French army

led by Moreau and the Austrians under Archduke John. The Austrians were ordered to advance and encircle the French troops; but Moreau outwitted the enemy by moving forward. On the march through bad roads and forest country, the Austrians became disorganized and the French were able to attack and defeat them. Their losses amounted to more than 20,000 killed and wounded; 12,000 prisoners were taken. With Napoleon's victory at Marengo, this battle ended the War of the Second Coalition.

HOHENZOLLERN, a royal family in Germany, named from the castle of Hohenzollern or "high tower," situated in Swabia, near the sources of the Danube and north of Lake Constance. As counts, the Hohenzollerns can trace their ancestry to the 12th century, but it was not until the 15th century that they became important to the historian. The family then divided itself into two branches—elder and younger.

The head of the house, Frederick, was Burgrave of Nuremberg. But in 1415 he purchased the then vacant Margraviate of Brandenburg from the Emperor Sigismund. For 200 years successive margraves ruled in comparative obscurity, when there arose Frederick William, who, reigning from 1640 to 1688 as "the Great Elector," transformed Brandenburg into a strong power by the addition of important territory in 1648. His son Frederick, 1688-1713, had himself crowned King in Prussia in 1701, because that part of the Hohenzollern lands lay outside the Empire and for it no allegiance was due the Emperor. Later, with imperial assent the title was changed to King of Prussia. He was succeeded by Frederick William I, 1713-40, and he by his eldest son Frederick II, the Great, 1740-86. Then followed in succession Frederick William II, 1786-97, Frederick William III, 1797-1840, and Frederick William IV, 1840-61, all three unimportant and colorless rulers. In 1861 William I, 1861-88, brother of Frederick William IV came to the throne. He was already 64 years old and thought seriously of withdrawing. Yet it was in his reign of 17 years that German unification was effected and in 1871 he was proclaimed German Emperor. He was succeeded by his son Frederick III who had married Victoria the oldest daughter of Queen Victoria of England. Unfortunately he died after three months from cancer of the throat and the Hohenzollern and imperial sceptre fell into the hands of his versatile but somewhat neurotic son, William II who led Germany through the World War, and in Nov. 1918 abdicated and fled to Holland.

HOISTING, in mining, the raising and lowering of men and supplies in the mine, and the bringing of mined ore and rock to the surface for treatment. Skips are used to hoist ore, while men and supplies utilize cages which often resemble an ordinary freight elevator. A steam or electrically driven hoisting machine is on the surface near the shaft in which Skips or Cages travel, and winds the cable carrying them over a drum.

HOISTING APPARATUS AND MACHINING heavy weights by utilizing the available power to the best advantage. The hoist by itself creates no power; it simply enables the available power to be used advantageously to secure the desired results. The simplest hoisting device is the Block and Tackle which increases one's capacity to lift a weight in the same proportion as the speed of lifting is decreased. Small Cranes have hand hoisting apparatus while large cranes use power hoists, usually operated by either electricity or air. The type of hoisting apparatus is determined by the weights to be lifted and the speed desired. Cranes of the traveling types also have motors that move the crane with its load to any desired point.

HOKAN, a collective term for a group of American Indian languages which includes, according to some students, notably A. L. Kroeber and R. B. Dixon, the following North American linguistic stocks, previously considered distinct, but believed by them to be genetically related: Achomawi, Chimariko, Esselen, Chumash, Karok, Pomo, Shasta, Salinan, Washo and Yana, all in or near California, and Seri and Tequistlatecan in Mexico. After a reexamination of the evidence of relationship between these languages, E. Sapir added to the inclusive stock Coahuiltecan, Karankawa, Tonkawa, Subtiaba in Nicaragua; and made the added suggestion that Siouan, Muskhogean, Caddoan and Iroquois would ultimately prove to be related to the combined Hokan-Coahuiltecan. This grouping of linguistic stocks is, however, accepted by few authorities in its entirety.

HOLBEIN, HANS, the Younger (1497-1543), German artist, the son and pupil of Hans Holbein the Elder, was born in 1497 at Augsburg. About 1515 he



THE BISHOP, ONE OF THE 58 WOODCUTS OF HANS HOLBEIN'S "THE DANCE OF DEATH"

left Augsburg for Basle, where he worked as a book-illustrator and mural painter. The outstanding works of this period are the *Dance of Death* woodcuts and the famous *Madonna of the Burgomaster Meyer,* now

bearing a letter of introduction from Erasmus to Sir Thomas More. His first patrons were Warham, Wyatt and the merchants of the Steelyard, but after 1537 Holbein became attached to the court of Henry VIII, in whose service he remained until his death of the plague, at London, in 1543. The 87 red chalk drawings at Windsor Castle and the many fine portraits scattered throughout England and Europe are a pictorial history of Tudor times, an immortal record of such leading figures as Henry VIII, Prince Edward,



COURTESY M M OF ART

THE PLOWMAN, IN "THE DANCE OF DEATH"

Anne of Cleves and Jane Seymour. Holbein's technique was that of a miniature painter, delicate, detailed and highly finished. His line was incised, his color jewel-like, his attitude detached. The little profile portrait of *Erasmus,* now in the Louvre, Paris, is considered his masterpiece. Other noted works are the *Falconer,* at The Hague, *Christina of Denmark,* in the National Gallery, London, and two portraits of Prince Edward in American private collections.

HOLBERG, LUDVIG VON (1684-1754), Norwegian-Danish dramatist, was born at Bergen, Norway, Dec. 3, 1684. He studied at the University of Copenhagen, where he afterwards became a professor, first of metaphysics and finally of history and geography. His first writings were serious historical works, but it is by his comedies that he is remembered. These were written for the first Danish theater opened in Copenhagen. Previous to his time there had been only French and German theaters. Among his best known plays are *Erasmus Montanus, The Busy Man, The Lying-in Room, Jeppe of the Mountain, Jakob von Thybo, The Fickle One* and *Jean de France.* In a similar tone to that of the comedies were *Peder Paars,* a comic-heroic poem, and *Niels Klim's Underground Journey.* The latter was written in Latin and later translated into Danish by Jens Baggesen. During his student years Holberg traveled extensively in Holland, Germany, France, Italy and England. Although he was born in Norway, all his active years were spent in Denmark, and he is often called the father of the Danish drama. He died at Copenhagen, Jan. 28, 1754.

HOLD, pertaining to a vessel is the space for carrying cargo. This space for cargo ships is both forward and aft of the machinery space amidships, and is as large as possible. In fast Atlantic liners and in passenger vessels, the holds are small and generally for trunks and miscellaneous belongings of the passengers.

HOLDEN, EDWARD SINGLETON (1846-1914), American astronomer, was born at St. Louis, Mo., Nov. 5, 1846. In 1873 he became associated with the Naval Observatory, was director of the Lick Observatory from 1886 to 1889 and founded the Astronomical Society of the Pacific. In 1901 he became librarian of the United States Military Academy. He died at West Point, N.Y., Mar. 16, 1914.

HOLDENVILLE, a city in southeastern Oklahoma, the county seat of Hughes Co., situated about 80 mi. southeast of Oklahoma City. Bus and truck line and two railroads afford transportation. Cotton, corn, potatoes and peanuts are the principal crops of the vicinity. Holdenville is a shipping point for agricultural products, and an industrial center for meat packing and cottonseed oil manufacture. The city was founded in 1895 and incorporated in 1898. Pop. 1920, 2,932; 1930, 7,268.

HOLDING COMPANY, a corporation which combines the business and properties of other corporations through ownership of all or a controlling majority of their capital stocks. For obvious economic reasons it rapidly became a favorite instrument of trust promoters. Since so many businesses in the United States were organized as corporations it was easier and cheaper to combine them in a holding company than by outright purchase. Furthermore, at a time when TRUSTS were extremely unpopular, a semblance of independence could not be maintained to the advantage of the trust. *See also* SHERMAN ANTITRUST ACT and CLAYTON ACT.

HOLIDAY, a day set aside for the celebration of some event, either religious or civil. Holidays are observed by the ceasing of ordinary work or business, by recreation, by feasting and in some cases by fasting. In the United States there is, strictly speaking, no national holiday, all legal holidays being subject to the legislation of the states and territories, although certain events are celebrated throughout the nation on the same day. It is customary for the President to issue a proclamation setting apart the last Thursday in November for Thanksgiving, which makes it a legal holiday in the District of Columbia only; the governors of all the states and territories issue similar proclamations, however. Independence Day (July 4th) and Labor Day (first Monday in September) are legal holidays in all states and territories except the latter in the Philippines; New Year's (January 1st) is a public holiday throughout the nation and possessions; and Christmas (December 25th), a public re-

ligious holiday is observed in all the states and territories. The other principal legal or public holidays include the following: *Lincoln's Birthday,* Feb. 12th, observed in Alaska, California, Colorado, Connecticut, Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan Minnesota, Missouri, Montana, Nebraska, Nevada, New Jersey, New York, New Mexico, North Dakota, Ohio, Oregon, Pennsylvania, South Dakota, Tennessee, Utah, Washington, West Virginia, Wyoming, and, by governor's proclamation, in Massachusetts; *Washington's Birthday,* Feb. 22nd, celebrated in all states and territories; *Good Friday,* variable date, observed in honor of the crucifixion of Christ, celebrated legally in Connecticut, Delaware, Florida, Louisiana, Maryland, Minnesota, New Jersey, Pennsylvania, the Philippines, Porto Rico, and Tennessee; *Memorial or Decoration Day,* May 30th, celebrated in honor of those who died in the military and naval service of the United States by all the states and possessions, except Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina and South Carolina, most of the southern states having a similar holiday, the date of which varies; *Columbus Day,* Oct. 12th, celebrated in Arkansas, Arizona, California, Colorado, Connecticut, Delaware, Florida, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Washington, West Virginia, and Porto Rico; *Election Day,* Tuesday after the first Monday of November, observed in all states and territories except Alaska, District of Columbia, Hawaii, Illinois, Massachusetts, Mississippi, Ohio, the Philippines and Vermont; *Armistice Day,* Nov. 11th, observed in memory of the signing of the armistice which ended the World War, celebrated in Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Illinois, Iowa, Louisiana, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Jersey, North Carolina, North Dakota, Pennsylvania, Rhode Island, South Dakota, Tennessee, Texas, Vermont, Virginia, Hawaii, and in other states by governor's proclamation only. Many other special holidays are celebrated in the various states and territories in honor of some particular event or person in their history. Holidays were originally "holy" days, as the birthdays of saints and were celebrated according to religious dictates, but these have been superseded in importance by secular holidays. These are valuable for the rest and recreation they afford and the patriotic spirit which they promote.

HOLINESS CHURCHES IN THE UNITED STATES grew out of the missionary activities of the Rev. Hardin Wallace, a minister of the Free Methodist Church, who with another minister, about 1880, journeyed through Southern California and Arizona, preaching and organizing Holiness Bands among Christians who still retained their membership in their own churches. With the development of these bands and the acquisition of certain property for their worship, legal difficulties arose, and in 1896 they became incorporated under the laws of the State of California. Since that date they have spread to Kentucky, Tennessee, Indiana and elsewhere. The doctrines of the Holiness churches are akin to those held by the Methodist churches, except that they lay more stress on the "sanctification of all believers," meaning thereby, "freedom from the tendency to sin." They preach repentance, restitution, confession and forgiveness of sin, and believe in divine healing by faith on the part of the sick and those who seek the restoration of the sick. The specific conditions of church membership include baptism, belief in the second coming of Christ, prohibition of intoxicating drink, abstinence from tobacco and drugs, and repudiation of secret societies, jewelry, extravagance and divorce, except on account of adultery. The local churches are self-directing; but a board of 12 elders cares for the general welfare as a General Assembly. The ministry is not a separate class, no fixed salaries are paid, and their ministers often live by other occupations. There are no church taxes, as the support of all work for new churches, schools and benevolences comes from freewill offerings.

HOLINSHED, RAPHAEL (d. 1580), English chronicler, was born probably at Sutton Downes, Cheshire. It is generally believed that he attended Cambridge University. He is known chiefly as the author of *Chronicles of England, Scotland and Ireland,* a work begun by Reginald Wolfe and completed by Holinshed about 1577. Much of the material for the historical plays of the Elizabethan dramatists was drawn from the *Chronicles,* including that for Shakespeare's great series of historical plays and portions of MACBETH, KING LEAR and CYMBELINE. Holinshed died about 1580.

HOLISM, a philosophical position emphasizing the importance of wholes. It is opposed to mechanism and would extend the principle generally accepted for organisms to the entirety of inanimate objects. The concept of the whole is used for the interpretation of all the phenomena of nature.

Holism maintains that the whole is more important than any of its constituent parts, and that the mere sum of its component parts will never produce a whole similar to the original. In other words, the whole is the original and the parts are secondary. By taking the parts separately and putting them together one does not get a whole. Holism thus opposes the mechanistic principle of the parts preceding the whole.

Although holism extends its principle to inanimate nature, it nevertheless makes a distinction between types of wholes. Those lower in order approach more nearly toward mechanism but do not reach it; those higher in the series embody more of the organic principle. The electron, the proton, the atom, the molecule, the cell, the individual and the state are all wholes of the type under consideration. Each has its own individuality and its characteristics are determined both by the relation of the parts to the whole

and the whole to the parts. The holistic principle here is that the relation of the whole to the parts produces a different unit from what would be obtained by merely uniting the parts into a whole.

HOLLAND, CLIFFORD MILBURN (1883-1924), American engineer, born at Somerset, Mass., Mar. 13, 1883. Soon after his graduation at Harvard he began to undertake tunnel work, becoming assistant engineer of the Joralemon Street tunnel, Brooklyn, connecting Manhattan with Long Island. From then on he took charge of other tunnels from the City to Long Island. Holland was the chief engineer of the New York and New Jersey Interstate Bridge and Tunnel Commission for the construction of the vehicular tunnel under the Hudson River which was named after him. He died at Battle Creek, Mich., Oct. 27, 1924.

HOLLAND, JOHN PHILIP (1844-1914), American inventor, was born in County Clare, Ireland, in 1844. He was educated at Limerick and after teaching school in Ireland for 10 years he went to Paterson, N.J., where he continued his profession. During the Civil War the conflict between the *Merrimac* and *Monitor* gave him the idea of the submarine, and he began experimenting with plans. After 15 years of study his first design was submitted to the U.S. Navy in 1875 and refused on the ground that the perils of operation were too great. Nevertheless, he began building models of this type of vessel and in 1898 completed the *Holland* which was purchased by the government and used as a pattern for additional craft. The British admiralty obtained patents for this submarine for Great Britain, which fact was a bitter disappointment to Holland who had conceived the boat with the idea of destroying England's naval supremacy, and to help obtain Irish independence. He died at Newark, Aug. 12, 1914.

HOLLAND, WILLIAM JACOB (1848-), American zoölogist and paleontologist, was born in Bethany, Jamaica, West Indies, Aug. 16, 1848. He was ordained in the Moravian ministry and after holding several parishes became chancellor of the Western University of Pennsylvania (now Pittsburgh), in 1891. From 1898 to 1922 he was director of the Carnegie Institute of Pittsburgh. He participated as naturalist in an eclipse expedition to Japan in 1887, and published numerous works upon zoölogy and paleontology, particularly of the Tertiary and Jurassic. He also made a study of butterflies and is the author of *The Butterfly Guide* and *The Moth Book*.

HOLLAND. *See* NETHERLANDS, THE.

HOLLAND, a city of Ottawa Co., southwestern Michigan, situated on Macatawa Bay, near its confluence with Lake Michigan, about 25 mi. southwest of Grand Rapids. The city is served by the Pere Marquette Railroad, bus lines and steamboats. There is an airport. The surrounding district produces grain and fruit, and is also industrial. The local manufactures include furniture, furnaces, grist mill products and machines. In 1929 the factory output was valued at $17,796,031. The retail business in 1929 amounted to $9,885,514. Near by are numerous summer resorts, on Lake Michigan and Macatawa Bay, among them Ottawa Beach, Castle, Macatawa and Jenison parks and Waukezoo, all adding to the city's industrial wealth. The Western Theological Seminary and Hope College, both controlled by the Dutch Reformed Church in America, are located here. In 1847 Dutch settlers founded Holland. The city received a charter in 1867. Pop. 1920, 12,183; 1930, 14,346.

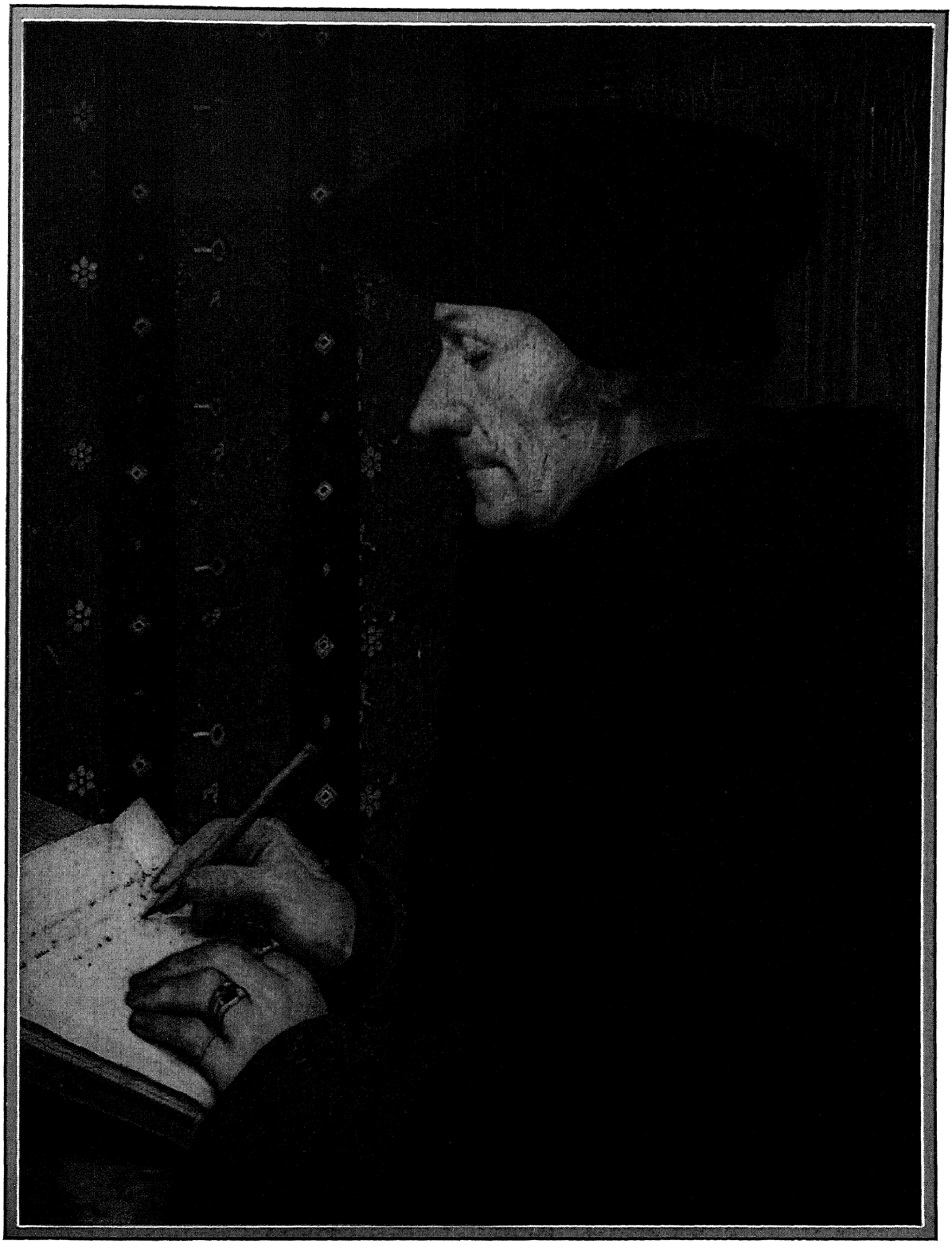
HOLLAND LAND COMPANY, 1792-1834, a firm engaged in a speculative enterprise in wilderness lands in the United States, particularly in western New York. Promoted by Peter Stadniski and Sons, bankers of Amsterdam, and other Dutch banking houses, the Holland Land Co. had purchased through an American representative, Theophile Cazenove, 1,800,000 acres at the time of its formal organization, 1796. The collapse of the land boom in that year made it necessary to sell the lands directly to settlers. The lands in western New York were used as experimental ground, and were first opened for sale. Under the able supervision of Joseph Ellicott, the settlements along the Genessee River made some progress. But inability of the pioneers to meet payments, difficulties of communication and marketing and controversy over the rights of alien proprietors in New York State handicapped the company. A policy of indulgence to remiss settlers produced no dividends. In 1834 the company took advantage of a rising market in lands to sell all its holdings.

HOLLEY, MARIETTA (1850-1926), American author, was born in 1850 near Adams, N.Y. At 16 she was writing for the country press and was soon famous for her stories about "Samantha," and "Josiah Allen's Wife." Perhaps the best of the Samantha books is *Samantha Among the Brethren.* She wrote under the pen name of Josiah Allen's Wife, and is one of the few woman writers who is well-known as a humorist. She died at Pierrepont Manor, N.Y., Mar. 1, 1926.

HOLLIDAYSBURG, a borough and the county seat of Blair Co., situated in central Pennsylvania, 4 mi. south of Altoona, on the Juniata River and served by the Pennsylvania Railroad. Ganister rock and limestone are produced in the vicinity. The local industries are foundry, machine and railroad shop work. The town is chiefly residential. Highland Hall, a school for girls, is located here. Pop. 1920, 4,071; 1930, 5,969.

HOLLOW RELIEF (*cavo-rilievo*), one of the two kinds of *intaglio* sculpture, the sort called *intaglio rilevato.* It is a sunken bas-relief, used commonly in the wall-carvings of the ancient Egyptians, in which the figure is outlined by a deep groove.

HOLLY, a genus (*Ilex*) of attractive woody plants of the holly family (*Aquifoliaceae*), several of which are highly prized in cultivation for their ornamental foliage and handsome red berries. There are about 175 species found widely throughout the world, but most numerously in South America, especially in

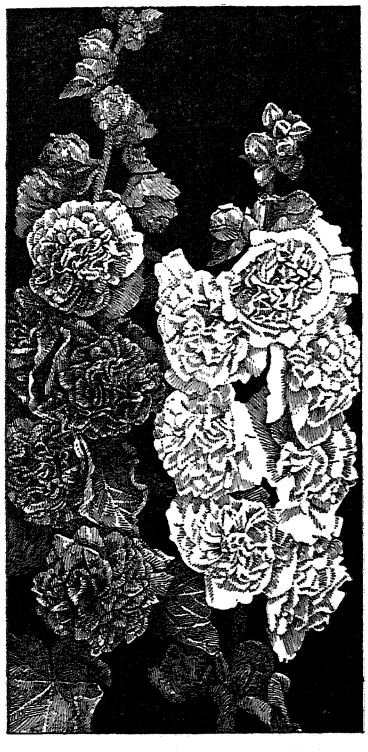


"ERASMUS"

By Hans Holbein, the Younger (1497-1543). In the Louvre, Paris.

Brazil and Guiana. They are mostly shrubs and small trees bearing medium-sized, undivided leaves, small greenish flowers and red, yellow or black berries, which often remain on the branches throughout the winter. The English holly (*I. Aquifolium*), a slow-growing tree, sometimes 40 ft. high, native to Europe and Asia, bears wavy-margined, spiny-toothed, evergreen leaves and showy scarlet fruit. Numerous forms with greatly variegated foliage are cultivated. This elegant ornamental, long a favorite in English gardens, thrives in the Southern States and also on the Pacific coast from California to British Columbia. The American holly (*I. opaca*), usually a small tree, but sometimes 100 ft. high, grows from Massachusetts to Florida and Texas, chiefly near the coast. It bears oblong evergreen leaves, with a few spiny teeth, and dull red fruit. The beautiful white wood of both the foregoing is highly valued for cabinet work and turnery. Their fruit-bearing branches are extensively used for Christmas decorations. *See also* MATE.

HOLLY FERN, a common name given to various species of *Polystichum,* a genus of true ferns, because of their bristly, spiny-toothed leaflets. They are natives chiefly of woodlands in temperate regions; several



HOLLYHOCK

are grown as ornamentals. Among those occurring in the United States are the true holly fern (*P. Lonchitis*) and the Christmas fern (*P. acrostichoides*), both widespread east of the Rockies, and the bristle fern (*P. aculeatum*) of the Pacific coast.

HOLLYHOCK (*Althæa rosea*), a tall, leafy-stemmed, highly ornamental biennial native to China, very widely planted in gardens. The unbranched, spire-like, hairy stems grow from 5 to 9 ft. high bearing large, wrinkled, round, heart-shaped leaves and showy flowers in a long, wand-like spike blossoming in late summer. Numerous double forms and color varieties are in cultivation.

HOLLY SPRINGS, a city in northern Mississippi, the county seat of Marshall Co. It is situated 46 mi. southeast of Memphis, Tenn. and served by two railroads. The city is a center for the cotton trade and the seat of Holly Springs Normal Institute, the North Mississippi Presbyterian College and Rust University for Negroes. The Battle of Holly Springs was fought here on Dec. 20, 1862. The city was chartered in 1837. Pop. 1920, 2,113; 1930, 2,271.

HOLLYWOOD, a residential and semi-industrial section of Los Angeles, Cal. The Pacific Electric railway affords transportation. Hollywood is an independent station of the Los Angeles post office. With a climate especially favorable to the taking of motion pictures, Hollywood erected its first picture studio in 1910. Since then its name has become a synonym for the motion picture industry. Upwards of 75% of the American output of "movies" or "talkies" is produced here. Hollywood was first laid out in 1887 and was consolidated with Los Angeles in 1910. Pop. 1930, 154,000.

HOLLYWOOD, a city in Broward Co., southern Florida, situated on the Atlantic Coast, 18 mi. north of Miami. The Florida East Coast and the Seaboard Air Line railroads provide transportation. Truck crops, tomatoes and oranges are grown in the vicinity. The city is a popular winter resort, with a six-mi. beach and numerous hotels. Hollywood was founded in 1922 and incorporated in 1926. Pop. 1930, 2,869.

HOLMES, OLIVER WENDELL (1809-94), American physician, novelist, poet and essayist, was born in Cambridge, Mass., Aug. 29, 1809, the son of a New England clergyman. He had a happy and wholesome childhood, attended Phillips Academy, Andover, Mass., and graduated at Harvard in 1829. He wavered between the professions of law, medicine and authorship; after studying law one year and publishing several poems while in school, he settled on medicine. From 1833-36 he studied abroad, mainly in Paris, returning to Boston in the latter year. For two years, 1838-40, he lectured on anatomy at Dartmouth College; in 1840 he married Amelia Lee Jackson of Boston. Holmes was appointed Professor of Anatomy and Physiology at the Harvard Medical School in 1847, a position he held for 35 years. He was never an outstanding figure in his profession, and his best known contribution to medical science was his essay on *The Contagiousness of Puerperal Fever,* 1843. In a literary way Holmes was known locally as an extremely graceful poet, the author of a few essays, but chiefly he was noted as a brilliant conversationalist. But in 1857 he became widely famous as the author of *The Autocrat of the Breakfast Table,* a series of 12 essays which appeared in the

newly founded *Atlantic Monthly,* a periodical named by Holmes himself and edited by JAMES RUSSELL LOWELL. *The Autocrat,* published in book form in 1858, was followed the next year by *The Professor at the Breakfast Table,* also first printed in the *Atlantic Monthly.* These two works definitely established Holmes's reputation. He later wrote three novels, *Elsie Venner,* 1861, *The Guardian Angel,* 1867, and *A Mortal Antipathy,* 1884; several volumes of poems, of which *Before the Curfew,* 1888, was his last; and other prose works, including *The Poet at the Breakfast Table,* 1871, and *Over the Tea Cups,* 1890. Of his single poems the best known are perhaps "The Chambered Nautilus," "Old Ironsides," "The Last Leaf," "Dorothy Q.," and "The Wonderful One-Hoss Shay." All of Holmes's works, from his medical lectures to his essays and poems, reflect his delightful personal qualities, his genial humor, tolerance, warm human sympathy, his wit and vivacity. Holmes died in Boston, Oct. 7, 1894. *See also* AMERICAN LITERATURE.

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HOLMES, OLIVER WENDELL (1841-), American jurist, son of the famous author of the same name, was born at Boston, Mass., Mar. 8, 1841. After graduating at Harvard in 1861, he entered the Union army as an officer, and was mustered out in 1864, having been thrice wounded. Admitted to the bar in 1866, he practiced law at Boston, and in 1870-73 edited the *American Law Review.* In 1882 he was professor of law at the Harvard Law School. That same year he was appointed to the Supreme Judicial Court of Massachusetts, serving for 20 years, the last four as chief justice. In 1902 he was named associate justice of the United States Supreme Court by President Roosevelt. The opinions rendered by Holmes as a Supreme Court justice are characterized by a remarkable lucidity of expression, great philosophic breadth, and a generally liberal point of view, and have made his name widely celebrated. His resignation from the Supreme Court in Dec. 1931, at the age of 90, was the occasion of a display of love and respect seldom accorded a retiring public official. His publications include *The Common Law, Collected Speeches* and *Collected Legal Papers.* A number of his famous opinions have been arranged by Alfred Lief in the *Dissenting Opinions of Mr. Justice Holmes,* 1929.

HOLMES, WILLIAM HENRY (1846-), American anthropologist and geologist, was born near Cadiz, Ohio, Dec. 1, 1846. After graduating in 1870 at the McNeely Normal College he engaged in explorations for the United States Geological Survey of which he was geologist in 1880-89. In 1894-97 he was curator of anthropology at the Field Museum of Natural History, Chicago, Ill., and professor of anthropic geology at the University of Chicago. From 1898 to 1902 he was head curator of the department of anthropology in the National Museum at Washington, D.C. Dr. Holmes became chief of the Bureau of Ethnology in 1902, resigning in 1909 to resume his work in the anthropological department of the National Museum, and to become curator of the National Gallery of Art. In 1920 he was made director of the National Gallery. He served as president of the American Anthropological Association during 1909-10. A pioneer field worker in anthropological explorations in America, he was considered a leading authority on American Indian antiquities. His writings, numbering more than 200 works, include *Aboriginal Pottery of the Eastern United States, Archaeological Studies among the Ancient Cities of Mexico,* 2 vols., and *Handbook of Aboriginal American Antiquities,* Part 1.

HOLMIUM, a metallic chemical element belonging to the RARE EARTHS, occurring together, with ERBIUM, in the minerals gadolinite and euxenite. Its chemical symbol is Ho, atomic weight 163.5; its salts give yellow solutions with a strong and characteristic absorption spectrum.

HOLODISCUS, a genus of spirea-like shrubs of the rose family. There are about 12 species native to western North America. They are usually small shrubs bearing deciduous leaves and very numerous creamy-white flowers in much branched terminal panicles. The cream bush (*H. discolor*), which grows 3 to 6 ft. high in canyons from Los Angeles to British Columbia, is cultivated as an ornamental.

HOLSTEIN, like the other Elbe Duchy of Schleswig in northwestern Germany, with which it forms one province, was annexed and incorporated into Prussia in 1866 and has ever since remained a political part of that country. Pro-Danish agitation during the World War was stringently suppressed by the Prussians and discouraged by the Danish Government. Post-war agitation for a rectification of the boundaries between Germany and Denmark resulted, in 1920, in a plebiscite which restored the northern part of Schleswig to Denmark. The latter's relations with the German minority have on the whole been amicable, no trace of coercion disturbing the security of the German-speaking population in the restored Danish zone of Schleswig. *See* SCHLESWIG-HOLSTEIN.

HOLSTER a receptable used for carrying a PISTOL or RIFLE. The U.S. Army pistol holster is attached to the belt on the right side. Mounted troops armed with the rifle carry it in a leather holster attached to the near side of the saddle. The rifle holster is officially named a scabbard and familiarly called a boot.

HOLT, LUTHER EMMETT (1855-1924), American physician, was born at Webster, N.Y., Mar. 4, 1855. Receiving his degree in medicine from the College of Physicians and Surgeons, New York, in 1880, he soon devoted himself especially to children's diseases and was professor of diseases of children at the New York Polyclinic Hospital from 1890 to 1901, thereafter being clinical professor of children at the same institution and physician-in-chief at the Babies' Hospital. He was also member of and sec-

retary of the board of directors of the Rockefeller Institute. Dr. Holt was best known for his contributions to the treatment of children's diseases, having published many articles and a monograph on "Diseases of Infancy and Childhood," but especially for a universally known handbook for mothers on "Care and Feeding of Children." While delivering a course of the newly founded Medical College at Peking, China, he died, Jan. 14, 1924.

HOLY ALLIANCE, a document rather than an alliance promulgated by the Tsar Alexander I in 1815. It stated that the sovereigns signing it would thereafter govern their conduct toward one another on the basis of holy religion, and their actions toward their subjects on those of a father toward his children. Originally, but unwillingly, joined by the King of Prussia and the Emperor of Austria, it was eventually signed by every ruler in Europe except the Pope, the Sultan, and the King of England. The Holy Alliance itself was nearly meaningless; but the name came to cover a definite, precise series of treaty agreements, and more particularly policies. Officially the Grand or Quadruple Alliance, aimed at maintaining the extremely conservative arrangements of the treaties of 1815, that is the *status quo.* The actions of the powers signatory to the Holy Alliance, but not acting as such, looking toward the reconquest of the Spanish colonies in America brought on the conversations between the United States and Great Britain which many scholars believe led to the Monroe Doctrine. *See* METTERNICH, CLEMENS WENZEL, PRINCE.

HOLY CROSS, COLLEGE OF THE, a Catholic institution for men, at Worcester, Mass., was founded in 1843 by the Rt. Rev. Benedict Joseph Fenwick, second Bishop of Boston. It is the oldest Catholic college in New England. Until it received its charter in 1865 students who graduated from Holy Cross received their degrees from GEORGETOWN UNIVERSITY. The college is controlled by the Fathers of the Society of Jesus of Worcester, Mass. The principal courses include arts and science, general science and pre-medical studies, and a Graduate School is maintained. The college operates under productive funds which amount to $673,723. The library contains 77,500 volumes. In 1930 there were 1,038 students and a faculty of 86, headed by the president, the Rev. John M. Fox.

HOLY CROSS, CONGREGATION OF, a religious institute of priests and lay brothers living in community under simple vows. Two French associations, the Brothers of St. Joseph, founded in Ruille about 1820, and the Auxiliary Priests of Le Mans, organized in 1835 in the commune of Holy Cross, Sarthe, were united by Father Basile Moreau for the joint works of preaching and teaching. In the United States the Congregation has many establishments, offshoots of the first (1842) and principal foundation at Notre Dame, Ind., where the University is a center of Catholic education in America. Among other colleges conducted by Holy Cross are those at Memramcook, N.B., and St. Laurent near Montreal. The congregation has served the missions of Eastern Bengal since 1852. Religious of Holy Cross number more than 800 in about 60 communities. Three sisterhoods, with a total membership of about 2,800, originated in the Congregation of Holy Cross: Sisters Marianites of Holy Cross, 1841; Sisters of the Holy Cross, 1869; and Sisters of the Holy Cross and of the Seven Dolors, 1883.

HOLY CROSS, MOUNTAIN OF THE, a mountain in Colorado, so called because of the huge figure of a cross which appears on its side from midsummer until late autumn. This cross is formed by snow which remains in two deep intersecting canyons after snow on the higher slopes and ridges has melted off. It is situated in Eagle Co., 30 mi. northwest of Leadville, and is the northernmost peak of the Sawatch range with an elevation of 13,978 ft.

HOLY GRAIL, THE, in the ARTHURIAN LEGENDS, the cup which Christ used at the Last Supper and which held His blood after the Crucifixion. Possibly of Celtic origin, the Grail legend was extensively developed by certain French poets of the 12th-15th centuries, notably Chrétien de Troyes and Robert de Boron, and in various prose cycles, as Malory's MORTE D'ARTHUR and others. The quest of the Grail was assigned first to Perceval, and later to Galahad, as in Tennyson's IDYLLS OF THE KING. In the version by Wolfram von Eschenbach (c. 1215), which Wagner used in PARSIFAL, the Grail is a mystic stone fallen from heaven.

HOLY GRASS, a small, sweet-scented grass (*Hierochloe odorata*), called also vanilla grass and Seneca grass. It is widespread in cold northern regions, occurring in North America from Newfoundland and Alaska southward to the northern United States. The plant grows about a foot high with smooth, unbranched stems, small narrow leaves and yellowish-brown and purple flowering spikes. Upon drying it emits a pleasing fragrance, due to the presence of coumarin. The grass is used by the Indians for making scented baskets. In northern Europe holy grass is spread before church doors on saints' days.

HOLYHEAD, a seaport of Anglesley, north Wales, situated about 264 mi. northwest of London on Holy Island. The parish church of Holyhead traditionally occupies the site of a 7th century monastery, part of the churchyard wall possibly being Roman. The harbor makes Holyhead an important port of embarkation for Ireland, and its mail and passenger traffic is considerable. Fishing and coasting trades, and some shipbuilding, supplement the harbor activities. Pop. 1921, 11,761; 1931, 10,707.

HOLY INNOCENTS (*Festum innocentium*), a church festival in remembrance of the slaying of the children in Bethlehem at Herod's order (Matthew 2, 16), celebrated Dec. 28. The Mass of that day is characterized by the omission of the Creed and Gloria and by the substitution of violet for red in the LITURGICAL COLORS. But on the day of the Octave and when the feast falls on Sunday, red and the Gloria are used.

HOLY ISLAND. *See* LINDISFARNE.

HOLY NAME, SOCIETY OF THE, or Confraternity of the Most Holy Name of God and Jesus, traces its origin to the Council of Lyons, 1274, which ruled that Christians should have a particular devotion to the Holy Name of Jesus. It has since become an indulgenced confraternity of the Catholic Church with the special purpose of securing reverence for the names of God and Jesus. The history of the society during the first centuries of its existence is somewhat obscure, although the Dominican preaching friars, who were selected by Gregory X to preach this devotion, are frequently mentioned in connection with this aspect of their work. In the 15th century Didacus of Victoria, a famous Spanish Dominican, founded the confraternity known as the Society of the Holy Name of God, which was approved by Pius IV in 1564 and later merged with the Society of the Holy Name of Jesus. The confraternity has spread rapidly in the United States, where it endeavors to suppress all profanity, blasphemy and improper language. Its members hold public processions and receive Holy Communion in a body at least once every three months, receiving plenary and partial indulgences which may be applied to souls in purgatory.

HOLYOKE, a city of southwestern Massachusetts on the Connecticut River about 8 mi. north of Springfield, served by the Boston and Maine and the New Haven railways and an airport. Primarily a manufacturing center, the city also embraces fine residential sections. Immense power is furnished by the river falls, dropping 60 ft. in 1.5 mi. Before 1849, when the falls were harnessed by a 1,017-ft. dam, Holyoke was a farming community; today the dam feeds three levels of power canals. Holyoke is one of America's chief producers of fine writing paper and also manufactures cotton, silk and woolen goods, machinery and school supplies. In 1929 the total factory output was about $76,000,000; the retail trade amounted to $29,062,235. It owns and controls its gas and electric plants and its water system.

Known as part of Springfield until 1774, when it became West Springfield, the town was incorporated in 1850 and the city chartered in 1873. Picturesque Mt. Tom overlooks the city. Both the town and America's oldest institution of higher education for women, Mount Holyoke College, in South Hadley (Center), are named for Capt. Elizur Holyoke. Smith, Amherst and other important colleges and schools are within 12 mi. of Holyoke. Pop. 1920, 60,203; 1930, 56,537; about one-third were foreign-born.

HOLY ROMAN EMPIRE, THE, as founded by Charlemagne in 800 and revived by Otto I in 962, rested on three fundamental concepts. First, it was a monarchy, theoretically absolute, the monarch's power resting on his coronation by the pope as head of the Christian Church. The emperor therefore represented the secular phase of divine authority. In practice the emperor was chosen by the German magnates, and after the fall of the Hohenstaufen papal coronation was frequently dispensed with. Second, pope and emperor were supposed to work in perfect harmony as God's chief representatives on earth, an ideal seldom realized. Third, the emperor was nominally superior to all Christian princes, on the theory that there should be a single secular head over all Christendom. In practice the emperor exercised no authority beyond Germany and Italy; after 1250 such authority as he possessed was limited to the Germanies. Indeed, the very title came to be, The Holy Roman Empire of the German Nation. Even in the Germanies the emperor's power rested chiefly on his position as a German prince. This was especially true of the Hapsburgs, who after 1273 with few exceptions monopolized the imperial title until the final extinction of the Empire in 1806. The Empire was provided with a constitution by the GOLDEN BULL of 1356, a document chiefly concerned with defining the method of imperial election, the rights of the German princes, and the titles and dignities of the emperor. The Imperial Diet consisted of the seven electors, the lesser princes, and representatives from the imperial cities. Theoretically a legislative body, it was in fact little more than a congress of diplomats with insignificant powers.

HOLYROOD PALACE, at Edinburgh, Scotland, the home of the former Scottish kings. It takes its name from, and was built on the site of, the Augustinian Abbey of the Holy Rood, founded in 1128 by David I on a spot where that king, protected by a miraculous cross or rood, had been saved from a wild stag. The abbey in 1544 and 1547 was stormed by the English, and only ruins of it remain. A fire in 1650 devastated the original Holyrood Palace, built in 1498-1503 by James IV, but it was rebuilt in 1671-79 after designs by Sir William Bruce of Kinross. Containing an excellent picture gallery and other rooms of interest, the palace has many associations with MARY STUART, Queen of Scots.

HOLY SEPULCHER, CANONS REGULAR OF THE, a congregation now extinct, which appears to have been instated in Jerusalem by Godfrey of Bouillon (d. 1100). The several churches they served in Italy and the Holy Land included those of the Holy Sepulcher, Mount Sion and Mount Oliver. Expelled by the Moslems, they established themselves in western Europe, where the Canonesses Regular of the Holy Sepulcher still exist. The canons disappeared with the French Revolution, except in Italy where in 1489 Innocent VIII had made over their property to the Knights of Rhodes (later, Knights of Malta).

HOLYSTONE, a soft sandstone used in blocks to scour the decks of ships. Modern holystones are fitted with handles by which they are pushed back and forth. Seamen were formerly forced to holystone on their knees, a fact which probably explains the origin of the name. Small holystones are dubbed "prayer-books." Some authorities contend that the word is properly holeystone, from the porosity of the blocks.

HOLY WATER, in the ritualistic churches the water mixed with salt and blessed by the priest as a symbol of spiritual cleansing. At certain services it is sprinkled with a holy-water sprinkler, aspergillum, by a priest. In personal use it is applied with the finger in the form of a cross to the forehead, breast, left and right shoulder. In churches holy water vessels are near the doors and are made of various materials, some, especially the medieval ones, being elaborate works of art. The solemn sprinkling (asperges) takes place chiefly on Sundays before the High Mass, and the holy water is blessed on certain feast days. The use of holy water was prevalent from the 4th century.

HOLY WEEK, in the calendar of the Christian churches, is the week before Easter, in which the passion of Christ is commemorated. The earliest reference to the week as one for special religious observances is in the APOSTOLICAL CONSTITUTIONS, written in the last years of the 3rd century, which urges all believers to abstain this week from wine and meat, and hold an absolute fast on Good Friday and Holy Saturday, or Easter eve, as Sabbatum Magnum was sometimes called. In this week also comes MAUNDY THURSDAY, which added to the special ceremonies the rite of feet-washing. The early Christians also kept vigil on Holy Saturday, as they expected the second coming of Christ on an Easter Sunday. The week is celebrated in several countries of Europe, notably in Spain, with street processions, music and the presentation of religious drama.

HOLZ, ARNO (1863-), German writer, was born at Rastenberg, East Prussia, Apr. 26, 1863. His work of criticism, *Die Kunst ihr Wesen und ihre Gesetze,* 1890-92, was considered advanced at the time of publication. In his poems Holz boldly departs from the traditional, by being free of rhyme and meter and centering all interest on the meaning alone. *Phantasus,* 1899, is a good example. This independence of opinion and of treatment make Holz one of the important figures in modern German literature.

HOMAGE AND FEALTY. *See* FEUDALISM.

HOMALKO, a North American Indian tribe speaking the Comox dialect of the Salishan linguistic stock. The few remaining individuals live on the east side of Bute Inlet, Brit. Col.

HOMBURG, a popular spa in the Prussian province of Hesse-Nassau, situated north of Frankfort-on-Main. From 1622 to 1866 it was the residence of Hessian landgraves. It has many visitors who lodge in the new district between the railway station and the handsome Kurpark, where the mineral springs are located. Besides the theater and the kurhaus, there is the former castle of the landgraves, built at the end of the 17th century. During the early centuries of the Christian era, Homburg was a Roman settlement and included a Roman fortress. Excavations have uncovered some 30,000 Roman articles, which are now in the museums. Pop. 1925, 16,412.

HOME ECONOMICS, the term applied to that body of organized subject matter concerning the solution of problems of the home and problems growing out of homes and their interrelationships. It draws upon all the basic sciences, physical, biological, social and economic, it cuts across their fields and organizes the material from this new point of view into the science of home economics. As in any new field of work, various divisions have been suggested. The most generally accepted are food and nutrition, economic studies, textiles and clothing, housing and equipment and family relationships.

Foods and nutrition have to do with the study of food composition, its use and its relation to health or nutrition. It is probably the best organized division of home economics, largely due to the possibility of drawing heavily in material and personnel from the science of nutrition. Information on food utilization is still largely a practical art, though research studies are developing it as an applied science and laying the basis for its scientific organization.

Economic studies direct the wise use of money and time in the home. The principles developed are applied in suggestions for budgets and time schedules and help give an appreciation of the woman's economic contribution to family living through household labor. Economics of consumption is the most neglected section of economic science. Research in this field by home economists is not on helping organize this field but acts as a stimulus to the development of this aspect of economic theory.

Textiles and clothing have to do with the development of textile fabrics for clothing and other home uses. There has been less fundamental research in the field of textiles and clothing of value to the homemaker than in foods and nutrition, partly because there is a less close relationship between clothing and health than between food and health. But considerable advance has been made in the establishment of desirable standards for fabrics and designs meeting needs for clothing and household uses.

In housing and equipment, home economics' contribution to housing has been retarded because of the highly commercial aspect of the field, the static ideas of house construction and the difficulty and cost of developing a research program. There is need for study of building materials and house designs which will meet the economic situation and the health and production needs of the modern household. Home furnishing is still largely an application of principles of art and efficiency; too little has been done in adapting these to lower economic levels. The housewife has demanded more knowledge upon which to base purchase and use of household equipment. Home economics investigations in this field tend to emphasize study of performance and bring together general considerations as a basis for the choice of the housewife.

Social studies have tended to emphasize the importance of relationships within the home in individual development. Research is being stimulated by welfare workers, child hygiene clinics and child development centers, as they see the close relation be-

tween maladjustment of children and unsatisfactory relationships in the home. L. S.

Home economics is taught in elementary and high schools, universities and colleges, private and technical schools and in teacher-training schools. The education of the housewife in modern housekeeping methods is carried on by well trained teachers through lectures and demonstrations; through cook books and other educational material dealing with the use of certain food products, issued by manufacturers of foods, household appliances and household utensils; by articles and bulletins issued by the U.S. Department of Agriculture, home magazines and institutes; and by radio. Important and valuable work in adult education in the rural districts is accomplished by "home demonstration" agents through the extension service of the government. At the close of 1930 there were 1,880 such agents working with farm women.

A recent report of the U.S. Department of the Interior, Office of Education, indicated that in higher institutions alone more than 50,000 students were being trained in home economics in 584 universities, colleges, teachers' colleges, normal schools and junior colleges; of this enrollment, 37,619 students were listed in home economics courses leading to a baccalaureate degree. In addition, courses were also offered by secondary and grade schools. Ten thousand high schools are now offering courses in home economics. Evening schools offering vocational courses in home economics enrolled 119,762 girls in 1929, and in addition 29,873 were enrolled in part-time classes and 99,478 in day schools. Formerly girls studied home economics in order to become teachers or to train themselves for the management of their own homes. Some students specialized in foods and nutrition, taking positions as dieticians in hospitals and other institutions; while others prepared for laboratory or research work. Important business opportunities for women are open as educational directors for food products and food equipment manufacturers; as consultants and as writers of publicity and advertising copy with marketing and advertising agencies; as lecturers and demonstrators of foods, food preparation, cooking and other household equipment. One of the important and attractive fields is that of directors of educational work in home economics for customers of the electric and gas utilities. This work consists of lectures and demonstrations, and other related community educational activities. There are now over 400 electric utilities in the United States carrying on home economics or home service work. F. C. L.

HOMEOPATHY, a system of medicine developed by Samuel Christian Friedrich Hahnemann, was based upon the conception "similia similibus curantur" ("like cures like"). In 1810, Hahnemann published *Organen der Rationellen Heilkunde,* the basis of the system. It included three tenets: that diseases or symptoms of diseases are curable by particular drugs which produce similar pathologic effects upon the healthy body; that the dynamic effect or force of drugs is increased by giving them in very small doses, and that chronic diseases are manifestations of suppressed stimuli which he called "psora."

Homeopathy became successful, so that it had its own hospitals and colleges. In 1880, there were twelve homeopathic medical colleges in the United States, and in 1900, twenty-two homeopathic colleges. By 1907, there were seventeen; in 1921, five, and in 1925 two. The practitioners of this system have gradually broadened their limitations, so that to-day the remaining homeopathic schools and hospitals practice a very slightly modified form of medicine. Regulation of practice by homeopathic practitioners varies in different states, in some being administered by a separate board, in others by a member of the regular board of medical registration and examination. M. F.

HOMER, the father, possibly legendary, of Western literature. To him has been assigned the authorship of the two great Greek epics, the ILIAD and the ODYSSEY, heroic recountings of the Fall of Troy and the homeward wanderings of ULYSSES. Whether or not they were the work of one man, it has now been fairly satisfactorily established that they had their origin about 800 B.C., and certainly the Greeks themselves believed a poet named Homer to be their author. By legend he was an old, blind, wandering bard. Eight biographies of him exist, but only add to the confusion; seven cities claimed to be his birthplace. The problem of the authorship of the *Iliad* and *Odyssey* has embroiled the world of scholars for generations; in Alexandria and Byzantium, in Italy, France, Germany, England and America the battle has raged, and is not yet decided. Only a few decades ago Samuel Butler set forth his theory, ingeniously defended, that Homer was a woman, and in 1931 appeared Victor Bérard's book, *Did Homer Live?,* claiming to prove once for all that Homer really existed.

In any case, Greece has realized, since the first, that in the *Iliad* and the *Odyssey* she had her greatest treasure. The sagas of the heroes of the Trojan war arose after a period of decadence which had followed the Fall of Troy. They seem to have originated in a desire to preserve for Greece the deeds and legends of her heroic period, to convey to later generations the high courage and warlike temper of the men of the 12th century before Christ. A sect of heirs or priests of the Homeric poems, called the *rhapsodes,* or the *Homerides,* of Chios, devoted their lives to the preservation, the purifying and the reciting of the poems. Peisistratus, tyrant of Athens, between 560 and 527 B.C. arranged, collated and transcribed the books, which, written in an ancient Greek and occasionally dropping into dialect, demanded, even at that early date, glosses and commentaries to be fully understood. They were textbooks in the schools of Greece, they were declaimed at the Panathenaea every four years by men so trained and grounded in them that any one of them could take up the recitation—which in its entirety consumed twenty hours—from any point of the narrative. They were used for exhortation and as the inspiration of other books and

dramas; in short, for centuries they were the Bible of the Greeks.

Although the Homeric books fell again into some disorder, and were again reshaped by the librarians of Alexandria, notably by ARISTARCHUS OF SAMOTHRACE, about 150 B.C., the entire Western world has shown itself almost continuously conscious of its heritage in them. For a while, in the early Christian period, they were less highly regarded than the AENEID, which was considered almost a precursor of Christian literature, but with the Renaissance they came into their own once more. To-day they are again the great basic books of classical education in every country; although whether or not Homer lived, and whether Smyrna, Rhodes, Colophon, Salamis, Chios, Argos or Athens was his birthplace, are still questions to which we have, as yet, no answer. *See also* EPIC; GREEK LITERATURE.

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HOMER, LOUISE, *née* Beatty (1874-), American contralto, was born at Pittsburgh, Pa., in 1874. She studied singing at Boston with Sidney Homer, the American composer, to whom she was married in 1895. Her operatic début was made in 1898 at Vichy, France, where she appeared as Leonore in *La Favorita.* She sang at Covent Garden, London, in 1899, and during 1900-19 was a member of the Metropolitan Opera, New York, and in 1920 joined the Chicago Civic Opera Co. Her popular rôles were in Wagnerian operas, notably Fricka in *Die Walküre.* In 1923 she was chosen as one of America's twelve greatest living women by the National Association of Women Voters.

HOMER, WINSLOW (1836-1910), American painter, was born at Boston, Mass., Feb. 24, 1836. After serving an apprenticeship with a lithographer, he made drawings for wood engravers.

In 1859 the young artist moved to New York, supporting himself by his work as an illustrator. He attended the night-class at the National Academy of Design, and when the Civil War broke out was competent enough to go with the army to make drawings for *Harper's Weekly.* The war was the inspiration of his first successful canvas, *Prisoners from the Front.* Subsequent to this, Homer's output was steady, as the artist depicted native subjects based chiefly on the Civil War, New England life and Negro character. His style developed in masterly ease of drawing, original composition, breadth of treatment and tone. He will be best remembered by his marine pictures, fishermen and sea-faring men of New England, though sometimes the background changes to the tropical richness of southern waters, as in *The Gulf Stream,* one of his finest canvases, in the Metropolitan Museum, New York. He also worked in water-colors with great spirit; in this medium he is noted for his thrilling scenes of marine life, as in *Lost on the Grand Banks* and *Shooting the Rapids.* Homer is without doubt the most American of American painters, self-taught, touched but little by European influences though he spent a year, 1867, in France. He died at Scarboro, Me., Sept. 29, 1910.

HOME RULE, in the United States the relative freedom of a city from interference by the state legislature. Secondarily, a system by which the people of a city may frame and adopt a charter for their own government. The term is peculiar to the United States. In British politics before 1922, the phrase refers particularly to the demand or policy of autonomy for Ireland. The movement for municipal home rule grew out of the evils of special legislation for cities. The earlier attempt to meet this evil by requiring the legislature to act only by general laws proved too rigid when faithfully observed and was often evaded because the courts in most states held to be "general," laws classifying cities by population. Home rule charters were first provided for in the Missouri constitution of 1875. Similar action has since been taken in California, Washington, Minnesota, Colorado, Oregon, Oklahoma, Michigan, Ohio, Arizona, Texas, Nebraska, New York and Wisconsin. The basis of home rule is the delimitation of a certain sphere of action over which the municipality has exclusive jurisdiction without disturbing state supremacy in other matters. Since it is very difficult to frame an adequate definition of a strictly municipal function, the scope of home rule varies greatly depending on the interpretation of constitutional provisions by the courts. The powers usually held to belong to the state rather than the city are police, education, taxation, public utility regulation and elections. The procedure in framing a home rule charter is, first, the selection of a board of FREEHOLDERS or charter commission. The calling of such an election can usually be forced by initiative petition. The charter commission prepares the charter and submits it to the people. If the people approve, it becomes the fundamental law of the city. In Minnesota the commission is appointed by the district court, and in Oregon, New York and Wisconsin the city council may act as a charter commission. Charter amendments may usually be submitted to the people by the city council or by initiative petition. T. H. R.

BIBLIOGRAPHY.—T. H. Reed, *Municipal Government in the United States,* 1926.

HOMESTEAD, a borough of Allegheny Co., southwestern Pennsylvania, situated on the Monongahela River, 6½ mi. southeast of Pittsburgh. Bus lines and several railroads afford transportation. There are two airports. Homestead is a part of the Homestead District, an important steel and iron manufacturing center, which includes several neighboring boroughs. The industrial products of the district are valued at $200,000,000 annually. The value of the manufactures of the borough of Homestead, 1929, was $3,136,223. In 1929 the retail trade amounted to $8,813,758.

The borough was plotted as a residential suburb

in the Monongahela Valley in 1870; it was incorporated in 1880. The first steel plant established in 1880-81 was later taken over by the Carnegie interests. In 1892 the National Amalgamated Association of Iron and Steel Workers called a strike against the Carnegie Steel Co. Serious results followed, and in the July riot seven men were killed. The state troops were sent to the scene of action as a precautionary measure. Pop. 1920, 20,452; 1930, 20,141.

HOMESTEAD ACT, an act almost a synonym for a free farm. As originally passed in 1862 it enabled the landless farmer to obtain title, practically without financial consideration, to a farm of 160 acres or less, on condition that he live thereon and cultivate it for a minimum period of five years. This period was reduced for ex-soldiers by the time spent in military service. The Act was the natural corollary of the Preemption Act of 1841 when the national policy of getting the public lands into occupied homes was finally put into statute form.

As the desirable farm lands of the Middle West were taken up, changes were made in the original law. In 1909 an enlarged homestead act was passed, allotting 320 acres or less of partly dry land to those entitled to enter for a homestead. In 1916, the limit in the stock range country was 640 acres, and the occupancy of the homestead for proving the claim was but three years. Yet, less than one-third of some of the western states is under state control. From 1868 to 1930 233,630,252 acres of public domain were proved on by homesteaders. On July 1, 1930, there was unappropriated public lands of 178,979,446 acres, and unpatented entries on July 1, 1930 amounting to 22,533,576.

The Homestead Law was but one of several acts designed to give land to bona fide settlers instead of distributing it through grants of large size to companies or corporations. Chief of these acts are the Timber Culture Act, 1873, Desert Land Act, 1877, Timber and Stone Act, 1878, Carey Act, 1894, Volstead Act in Aid of Drainage, 1908, and the Mondell Act, 1909. O. S. M.

BIBLIOGRAPHY.—B. H. Hibbard, *A History of Public Land Policies;* L. B. Schmidt and E. D. Ross, *Readings in the Economic History of American Agriculture.*

HOMESTEAD LAWS, laws securing the family home against alienation by husband or wife without the consent of the other, and against taking on execution or attachment upon judgments or other debts. All but seven of the states of the United States have homestead laws, sometimes embodied in the state constitution, more generally provided by statute. These statutes are held constitutional except so far as they may affect debts incurred prior to enactment. The term has been applied also to provisions of the federal statutes whereby a citizen may settle upon and become the owner of a specified portion of unappropriated public lands of the United States to be occupied as a homestead. *See* HOMESTEAD ACT.

HOMICIDE, the killing of one human being by another. The homicide death rate of the United States is by far the highest of any large civilized country for which comparable records are available. Annually some 10,000 to 12,000 persons meet such a violent death and possibly the number is even larger, for the rate shows a continuous increase. For 31 American cities, which in 1900 had a homicide death rate of 5.1 per 100,000, the rate had increased by 1915 to 8.6, and by 1930 to 10.9. The rate varies widely in different sections of the country, but it is uniformly highest throughout the southern states. The following cities in 1930 had a homicide death rate of 30 per 100,000 or more: Memphis, 58.8, Atlanta, 52.6, Lexington, Ky., 52.4, Birmingham, 49.1, Shreveport, 41.4, Augusta, Ga., 38.0, Nashville, 37.6, Miami, 36.8, Savannah, Ga., 36.4, Jacksonville, 34.5, Macon, 31.6, Mobile, 30.7, Gary, Ind., 30.6, Hamtramck, Mich., 30.1.

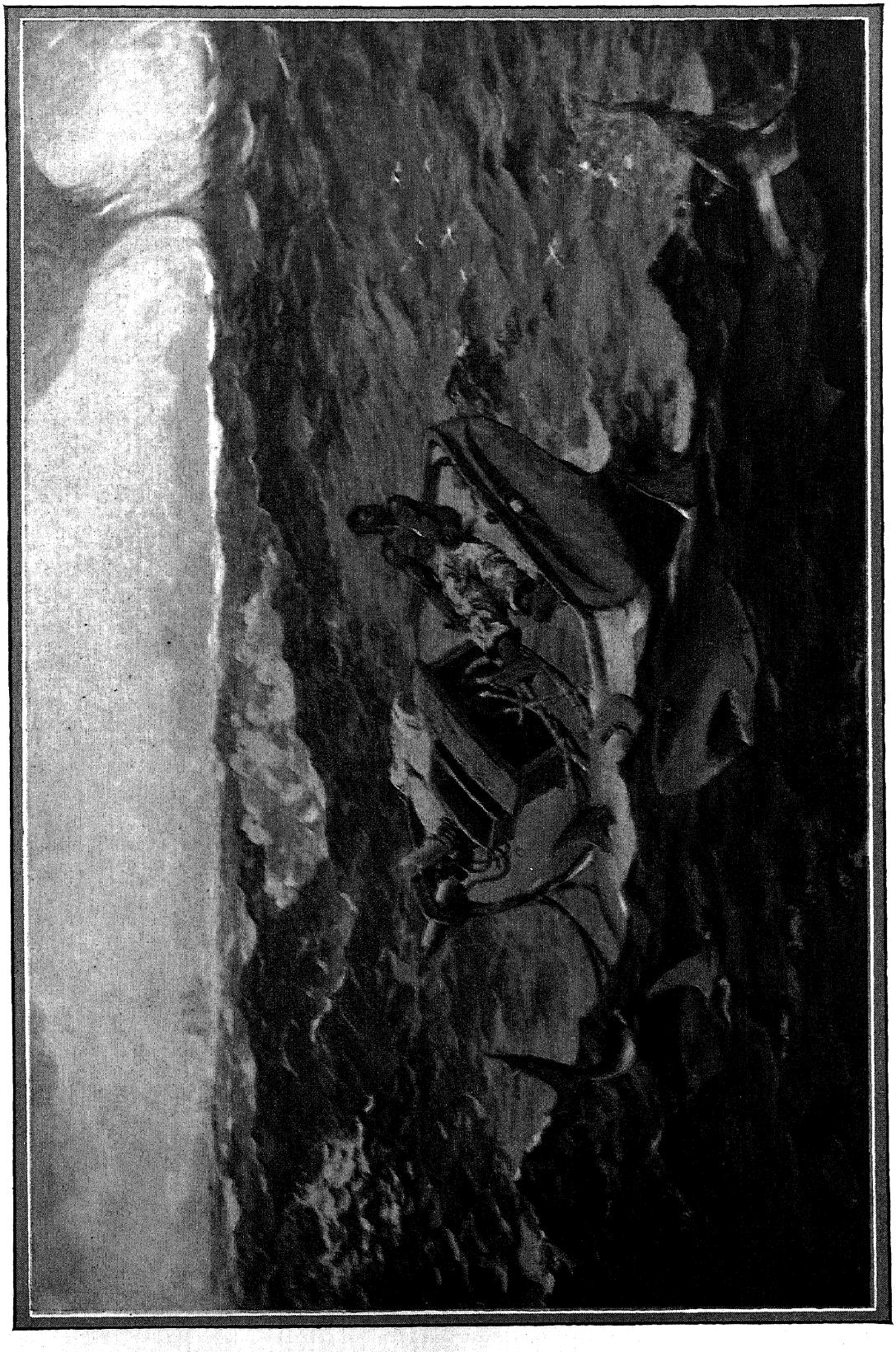
In 1930, 147 American cities with a population of nearly 40,000,000 had a homicide death rate of 11.0. The rate for Chicago was 14.4, for Detroit, 13.3, Los Angeles, 6.6, New York City, 7.1, and Philadelphia, 7.7.

In 1929 the U.S. Census Office had a record of 9,909 deaths from homicides in the registration area, equivalent to a rate of 8.5 per 100,000. While there were 85 deaths per million from homicide in the United States registration area, there were only 5 deaths per million from homicide in England and Wales. In 13 leading Canadian cities in 1928, with a population of about 2,500,000, 41 homicides occurred, or a rate of 1.7 per 100,000. Similar results only still more in contrast could be shown for other civilized countries.

The outstanding difference in homicide deaths of the United States and elsewhere is the predominating proportion of deaths due to firearms which in that country may be said to range from 47% for Boston to 77% for Memphis. In England and Wales in 1929, out of 204 homicides, 25 were due to firearms. A similar low proportion is common to most of the other countries of the world. F. L. H.

HOMILETICS treats of the art of preaching homilies or sermons, or deals with the use of the principles of rhetoric in public addresses on religion. As taught in the theological schools for the training of the Christian ministry, homiletics includes the analysis of the subject matter of the discourse, preparation of it, division into its component parts, its composition and delivery. The word is derived from the "homily" which in early Christian history was the principal sermonic form, namely, a running commentary on some passage of the Bible. This is known to have been the form of instruction given at the Catechetical School in Alexandria, the first school for the training of Christian preachers, where Origin and Clement were lecturers.

In the Middle Ages books of homilies were common and were used widely in such churches as lacked preachers. The Book of Homilies referred to in the Thirty-Nine Articles of the Church of England originated in 1542 and was composed to correct the errors of ignorant preachers.

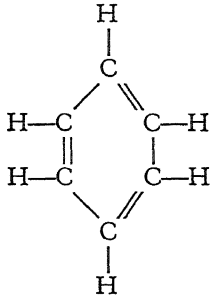


"THE GULF STREAM"

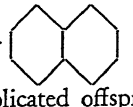
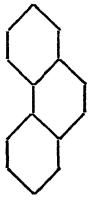
By Winslow Homer (1836-1910), in the Metropolitan Museum of Art.

HOMINY. *See* CORN MEAL.

HOMOCYCLIC COMPOUNDS, those organic chemical compounds containing a closed-ring nucleus of carbon atoms. Many varieties of saturated and unsaturated cyclic nuclei exist, containing from 3 to 8 carbon atoms, but by far the most important are those exceedingly numerous compounds, collectively known as the aromatic series, which are based upon a six-membered unsaturated nucleus. The simplest of these, and the parent substance of the entire series is BENZENE (C_6H_6), whose structural formula is now generally represented as



One or more of the hydrogen atoms may here be replaced by monovalent aliphatic alkyl groups, or even entire chains—then known as "side-chains"—by halogens, nitro- and sulpho-groups, giving rise to an almost unlimited variety of different compounds, in number as well as in structure, since even when only two identical groups are attached to the nucleus, these may be adjacent, separated by one hydrogen atom, or oppositely placed, thus creating three structurally different isomers. A hydroxyl group may replace a hydrogen atom, and produce a phenol with acidic properties if substitution takes place in the nucleus, but an alcohol, if in the side chain.

Two benzene rings may unite, without either losing its identity, but they may also fuse, in which case they have two carbon atoms in common and give rise to naphthalene, $C_{10}H_8$ or  , again the parent of a numerous complicated offspring; three rings fused together give anthracene,  or phenanthrene  , as shown in the figure.

W. J. L.

HOMOPTERA, the name of a suborder of bugs (*Hemiptera*). This group of insects includes a large number of widely different species. They may be winged or wingless. Except for the cicadas and lantern flies most of them are very small. All have sucking mouths, and many species are serious pests on plants, whose juices they suck. The most familiar kinds are the cicadas, tree-hoppers, lantern flies (so-called because of their shape), frog-hoppers or cuckoo-spit insects, leaf-hoppers, leaf bugs, jumping plant lice, mealy bugs, aphids and scale insects. The last two groups contain some of the most harmful of all insect pests.

HOMS, also known as Hims and Hems, a city of Syria, located near the Orontes, about 36 mi. from Hama, with which it is connected by rail. A French-owned line built in 1911 joins the town with Tripoli. Called *Emesa* by the ancients, Homs was celebrated for the beautiful temple in which Baal, the sun god, was worshipped. In the 3rd century the Emperor Aurelian here was victorious over Zenobia. Saracens captured Homs in the 7th century and the Crusaders invaded it in the 11th. Dilapidated walls encircle the city with the ruins of its castle and the remains of baths paved with mosaic are still evident. One of the mosques contains the tomb of Khalid ibn el-Welid, a famous Moslem warrior. Gold and silverware, cotton and silk cloth, are the principal items of trade in Homs. Pop. 1929, 52,792.

HONDURAS, a republic of Central America, bounded on the north by the Caribbean Sea, on the south by Nicaragua, the Pacific Ocean and Salvador, on the east by Nicaragua and on the west by Guatemala. The area is 46,332 sq. mi., with a coastline of 400 mi. on the Caribbean and 40 mi. on the Pacific. In 1930 the 90-year-old boundary dispute between Honduras and Guatemala was submitted to the United States for arbitration. The capital is TEGUCIGALPA.

Honduras is generally mountainous, sloping mainly towards the Atlantic and traversed in various directions by ranges or ridges which branch off from their common base in the central plateaus. All these elevated heights are interrupted by the great plain of Comayagua, which is a conspicuous feature of the land from both physical and economic standpoints. It is intersected by the two fluvial valleys of the Humuya and Goascoran, the former flowing due north to the Atlantic, the latter due south to the Pacific, so that the courses of both rivers jointly present a deep depression which extends from ocean to ocean and clearly indicates the direction of a marine channel flowing at one time between the Atlantic and the Pacific. The mountains of the southern half of the republic have the greatest elevation, attaining in places over 10,000 ft. altitude. Volcanic formations are almost entirely absent on the Atlantic slope but reappear on the Pacific side.

The climate is tropical along the coast, and in the interior mountains and plateaus is cool and healthful. On the Atlantic seaboard the yearly rainfall exceeds 100 in. and the temperature seldom falls below 70° F., and often stands at 100° and upward in the shade, whereas the mean for the interior ranges from 60° to 70°.

On the uplands the prevailing vegetation is herbaceous, and here the extensive plains covered with

succulent grasses supply an abundance of pasture for the numerous herds of horned cattle. The hot and marshy Atlantic coastlands are clothed with magnificent forest growths, including such valuable timbers as mahogany, rosewood, cedar (*Bursera*), logwood and brazil-wood. Sarsaparilla and other medicinal plants run wild. The indigo industry has declined and is replaced by trade in fruits such as bananas, plantains, coconuts and pineapples, for which there is constant demand in New Orleans and other markets of the Gulf states. The agricultural possibilities are remarkable. Cacao, sugar cane, coffee, tobacco and other tropical plants can be grown in immense quantities. Corn is the most important crop and is the principal food of the people. The chief exports are bananas, raw sugar, coffee, cattle and hides. Transport is relatively undeveloped but is being improved. There is a highway running from north to south, passing by the principal towns. Many parts of the country are richly mineralized. Silver ores are abundant, especially on the Pacific slopes, and among some of these ores are chlorides of remarkable richness. The gold washings of the Olancho district are being worked. Copper deposits occur, often with silver.

About three-fourths of the population may be classed as Ladinos, or Hispano-Italian half-castes who are of Spanish speech and constitute the Honduras nationality. Here the Sambos, African and Indian half-breeds, are the dominant element in some districts. The dark strain comes from blacks who were either wrecked on the coast or refugees from the West Indies in the 17th century. Near the Guatemalan frontier the cultured Maya peoples are still represented by the Chorti who speak a language of Maya stock. Pop. 1926, 700,811.

Honduras was the first of the allied states to withdraw from the Central American Confederation; and although a separate republic was constituted in 1839 its present charter dates only from 1894. There have been frequent revolutions and foreign wars. *See also* CENTRAL AMERICA.

History. CHRISTOPHER COLUMBUS first sighted the mainland of Honduras at Cape Gracias à Dios in 1502. Cristobal de Olid, one of Cortes's lieutenants, dispatched from Mexico, founded Triunfo de la Cruz in 1524. His cupidity was aroused by reports of the mineral wealth of the region, and he attempted to establish an independent government, but was assassinated by an emissary of Cortes in 1525. Honduras was later made a province of the captaincy general of Guatemala, and remained under that centralized administration until the successful revolt against Spanish rule in 1821. It was successively a part of Iturbide's Mexican empire and a member of the United Provinces of Central America.

Honduras was declared an independent state by a constituent assembly at Comayagua, Oct. 26, 1838, and in 1848 revised its formerly conservative constitution to establish freedom of conscience and religion. In 1841 the Bay Islands, territory belonging to Honduras, were appropriated by Great Britain. Seven years later Honduras, like Nicaragua, with which country it shared the Mosquito Coast, was menaced by the British seizure of the mouth of the San Juan River and the possible loss of its easterly lands to Great Britain. But in 1859 a treaty between Great Britain and Honduras restored to the latter country the Bay Islands and the threatened portion of the mainland. Honduras was linked with Salvador and Nicaragua in a loose confederation, 1849-63, and participated in other attempts at Central American unity. Roman Catholicism was adopted as the state religion in 1865; but a new constitution, promulgated on Sept. 2, 1904, established unprecedented personal liberty in other spheres. Relatively weak, Honduras suffered the frequent interference of neighboring countries in its domestic politics. Frequent revolutions have alternated with corrupt dictatorships; but more recently, conditions have tended to improve.

For Bibliography; *See* COSTA RICA, *History*.

HONDURAS, BRITISH. *See* BRITISH HONDURAS.

HONDURAS BARK, a medicinal bark obtained from a small tropical American shrub (*Picramnia antidesma*), sometimes called CASCARILLA BARK.

HONE, a fine abrasive, usually in the form of a block or stick, used for whetting a keen edge on cutting tools. Hones may comprise a natural or an artificial ABRASIVE, the latter being pressed into the desired shape. Hones are sometimes used on woodworking tools, on razor blades, and on some metal-cutting tools, such as reamers. HONING MACHINES are a recent type of abrading device used in finishing the bore of automobile cylinders and in similar work.

HONESDALE, a borough in northeastern Pennsylvania and the county seat of Wayne Co. It is situated on the Lackawaxen and Dyberry rivers, and served by an airport, bus lines and a railroad. Dairying and poultry raising are the chief rural interests. Coal, oil and clay are found in this region; and there are large tracts of timber. A mast of the *Constitution,* a United States frigate launched in 1797, was felled nearby. The important manufactures include electric elevators, silks, woolens, bobbins, shoes and underwear. The first steam engine to run on rails, the "Stourbridge Lion," built in England, made her maiden trip of two miles from Honesdale in 1829. The borough was founded in 1826 and incorporated in 1831. Pop. 1920, 2,756; 1930, 5,490.

HONESTY (*Lunaria annua*), an annual or biennial herb of the mustard family called also money-plant and satin-flower. It is a native of Europe and Asia, widely cultivated as a garden ornamental, and sparingly naturalized in the eastern United States and Canada. The plant grows about 2 ft. high bearing coarsely toothed leaves, large, pink-purple, fragrant flowers and very thin and flat, slightly oblong pods. Upon ripening the valves of the pod fall away leaving the thin shiny central partitions, which resemble spectacles in their rims, used in making dry bouquets.

HONEY, for centuries the chief sweet and most highly prized food, is the sweet viscid fluid collected from the nectaries of flowers and modified and stored in the honey comb by the honey BEE. As a food, honey is high in energy value and its sugars serve as fuel for muscle activity.

In addition to the several desirable sugars present it contains small amounts of protein, traces of acid, minute quantities of volatile substances which give it its characteristic aroma and flavor, and, as well, small amounts of phosphoric acid, calcium, nitrates, sulphates, and carbonates which combined with the salts of lime and iron contribute to the important mineral content of the food supply.

The sugars present in honey are SUCROSE (cane sugar) and invert sugar—a name applied to a mixture of DEXTROSE (grape sugar) and LEVULOSE (fruit sugar). The amount of cane sugar is very small.

Less than one-fifth of the weight of honey is water, the proportion varying in individual honeys. Basing food value upon the amount of energy in calories derived from a food, one pound of honey equals 1,485 calories, or one tablespoon of honey (1 oz.) equals 100 calories. *See also* PROTEIN IN FOODS. M. F. J.

HONEY DEW, a sweetish, sticky secretion of certain minute homopterous insects. Chief among these are the plant lice, of the family *Aphididæ;* others are the whiteflies, of the family *Aleyrodidæ,* and some of the scale insects of the family *Coccidæ*. Trees infested with honey dew insects often become covered with the secretion attracting swarms of insects to feed. This coating may become overgrown with smuts and other pernicious fungi.

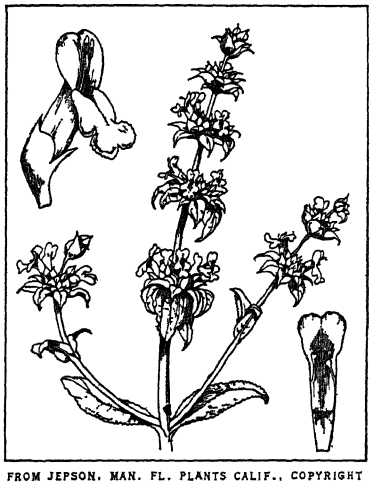
HONEY EATER, the name applied to a numerous family (*Meliphagidæ*) of over 250 species of passerine birds native chiefly to the Australian and New Zealand region. They are active birds, mostly much smaller than a thrush, usually with brilliant green and yellow often metallic plumage. In habits and appearance they somewhat resemble hummingbirds. They have a slender decurved bill and a long divided tongue ending in a brush which serves as a sucking organ. Their food consists chiefly of honey and small insects found among the flowers which they incessantly visit and fruits of forest trees.

HONEY GUIDE, one of a family (*Indicatoridæ*) of small Old World birds allied to the woodpeckers and barbets, so called because of their remarkable habit of leading men or animals to the nests of bees. There are about 18 species, all native to Africa except 2 which occur in the Himalayas and the East Indies. They range in length from 4½ to about 7 in., and have brown or black plumage often enlivened with yellow and white and stout somewhat finch-like bills. Their food consists of bees, grubs and other insects. Like certain cuckoos, the honey guides lay their eggs in the nests of other birds, chiefly those of the woodpeckers and barbets.

HONEY LOCUST (*Gleditsia triacanthos*), a handsome tree of the pea family, called also sweet locust and three-thorned acacia. It grows in moist fertile soils from Ontario to Florida, extending westward to Nebraska and Texas, and is widely planted as an ornamental. The trunk, sometimes 140 ft. high, is usually densely beset with stout, exceedingly sharp, often three-pronged thorns. On the slender, spiny branches are borne large leaves divided into numerous leaflets, inconspicuous greenish flowers, and broad, flat, somewhat twisted dark brown pods, containing hard seeds surrounded by a sweet, edible pulp. The hard, durable, reddish-brown wood is used chiefly for fence posts and in construction work.

HONEY PLANTS, a group of botanically unrelated plants, the nectaries of which furnish the material from which bees make honey,—often, and perhaps better, called bee plants.

While the common honey bee is not native in America it was soon introduced, and now uses a variety of native plants as well as the common Eurasian species to which it was long accustomed. Among native American plants rich in nectar, and much visited by bees are various mints, many Californian sages, the lindens, and many species of goldenrod. The chief honey plants, however, are still the clovers, alfalfa, buckwheat, mignonette, and the fruit trees, none of which are of American origin.



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

BLACK SAGE

(Salvia mellifera). Flower, flowering branchlet and longitudinal section of corolla. A valuable honey plant

Nectar-secreting glands are found in many flowers, usually so placed that a visiting insect brings foreign pollen to the flower, and carries with the load of nectar a fresh supply of pollen. Nectar, besides being the chief source of honey, is thus of major importance in securing cross-pollination. *See* POLLINATION.

N. T.

HONEYSUCKLE, the common name for a large genus (*Lonicera*) of woody plants of the honeysuckle family (*Caprifoliaceae*), comprising many popular ornamental shrubs. There are about 175 species, natives chiefly of north temperate regions, some 25 of which are found in North America. About 90 species,

together with numerous varieties and hybrids, are in cultivation. They are upright or climbing shrubs, bearing a profusion of pleasingly colored often fragrant flowers and attractive fruits. Among Old World species extensively planted are the woodbine honeysuckle (*L. Periclymenum*), the tartarian honeysuckle (*L. tatarica*), the Italian honeysuckle (*L. Caprifolium*) and the Japanese honeysuckle (*L. japonica*). The trumpet honeysuckle (*L. sempervirens*), a climbing evergreen shrub native to the Southern States, is widely grown for its scarlet, highly fragrant flowers.

HONG KONG, an island situated off the southeast coast of China, near the mouth of the Canton, or West River. The island, 32 sq. mi. in area, is separated from the mainland by a strait half a mile wide; on the shore of the mainland is Kowloon (3 sq. mi.), part of the colony. The island, a British Crown colony, was ceded by China to Great Britain in 1841. A considerable section of the mainland (356 sq. mi.) has been leased to Britain and is known as the New Territory. The town of Hong Kong, officially known as VICTORIA, is built on the northern slopes of the rocky height rising abruptly from the sea. Between the town and the mainland is the magnificent harbor with a water area of over 10 mi. It is a free port and in normal times is visited by 30,000 vessels yearly.

Hong Kong, or *Hiang Kiang* (fragrant lagoon), has shipbuilding plants, sugar and tin refineries and tobacco factories. A splendidly equipped university, with mainly Chinese students, was founded in 1911. Pop. of island, 1921, 347,401; 1931, 409,203.

HONING, in the old sense, is the sharpening of a tool on a fine piece of ABRASIVE, as in honing a razor. In the modern machine shop it is an internal grinding process in which the hone, or grinding head, fills the hole to be finished, both revolving and reciprocating in the hole. The hones or grinding heads consist of a framework carrying three to twelve sticks of abrasive. As used in automobile engine cylinders, the usual honing head carries six sticks. This method of finishing has proved both accurate and economical. *See also* GRINDING.

HONOLULU, capital and chief port of Hawaii, situated on the southwest coast of Oahu Island, facing a harbor protected by a breakwater of coral reef, in 21° 17′ 56″ N. lat., and 157° 51′ 48″ W. long. Punchbowl Crater crater, 500 ft. high, Waikiki and Diamond Head crater to the east rising 760 ft., are in the vicinity. Honolulu is coextensive with Honolulu Co., and covers an area of 600 sq. mi. It owes its importance chiefly to its position at the crossroads of transpacific shipping, and to its situation between the islands of the Hawaiian group, two factors which have made the city the metropolis of the central Pacific and the commercial center of Polynesia. The city has been laid out in modern style. The civic center, a large plaza filled with tropical flora, contains the Federal building, Territorial capitol and the structures housing the judiciary, government office force, the library and archives. The streets are macadamized, and the light, power, gas, water and sewer facilities are those of a modern American city. There are 200 acres of public parks. In 1920 the University of Hawaii was established in Honolulu. There is regular transportation to San Francisco, Vancouver, Peru, Hongkong, New York and other ports, and interisland communication by means of a small fleet. The population in 1930 was 137,582, an increase of 65.1% in 10 years.

HONORIUS, name of four popes and an antipope. Honorius I, 625-638, was excommunicated for heresy after his death. Honorius II, antipope, set up by a council at Basel in 1061 in opposition to Alexander II. He died in 1072. Honorius II, 1124-30, as legate of Callistus II, effected the Concordat of Worms with Emperor Henry V. Honorius III, 1216-27, confirmed the Dominican Order and the final rule of the Franciscans. He crowned Frederick II Emperor. Honorius IV, 1285-87, was a strenuous offender of ecclesiastical immunities against the house of Aragon.

HOOD, JOHN BELL (1831-79), American soldier and general in the Confederate Army, was born at Owingsville, Ky., on June 29, 1831. He was graduated from the United States Military Academy in 1853, and until 1859 was engaged in Texas frontier service. He joined the army of the Confederacy at the outbreak of the war, and as commander of the extreme Confederate right at GETTYSBURG, engaged in one of the most critical encounters of that battle. In 1864 he succeeded Johnston as commander of the Army of Tennessee. At the battle of Peach Creek, July 20, 1864, Hood was forced to retreat to the fortifications about Atlanta, which he evacuated on Sept. 1. His army was routed at Nashville, Tenn., on Dec. 15-16, 1864, in a gallant but hopeless battle with Gen. Thomas's army. Although consistently defeated, he was a skillful and courageous soldier. After the surrender at Appomattox, Hood was in business as a merchant in New Orleans, and served as President of the Life Association of America. Besides magazine articles, he was the author of *Advance and Retreat.* He died at New Orleans, La., on Aug. 30, 1879.

HOOD, THOMAS (1799-1845), English poet, was born in London, May 23, 1799. When only 22 he became an assistant editor of the *London Magazine,* associating with its famous contributors, including Charles Lamb and de Quincey. After publishing two earlier works, he gained recognition in 1830 with the appearance of the *Comic Annual,* a series which caricatured current events. In 1841 he became editor of the *New Monthly Magazine.* Hood collected his fugitive poems in *Whimsicalities* in 1844, in which year he also began a magazine of his own and received a pension of £100. Even in his humorous vein he is sympathetic and constructive, and love of his fellows marks his most famous poems. Among these are *Miss Kilmansegg, The Dream of Eugene Aram, The Bridge of Sighs* and *The Song of the Shirt.* Hood died in London, May 3, 1845.

HOOD, MOUNT, the highest peak in Oregon, occurring in the Cascade range about 50 mi. south-

east of Portland. It is an extinct volcano of unusually symmetrical outline, rising to a height of 11,253 ft. which was attained by successive volcanic eruptions. The rim of the ancient crater is still distinguishable at the summit. Although the volcano has been for a long time extinct, jets of steam still issue from vents in the slopes, especially near Crater Rock. The crest of the mountain is perpetually covered with snow and ice, giving origin to eight glaciers which extend down the sides of the mountain to about 6,000 ft. above sea level.

HOOFT, PIETER CORNELISZOON (1581-1647), Dutch poet and historian, was born in Amsterdam, Mar. 16, 1581. A precocious youth, he wrote and produced an actable tragedy at the age of 17. He traveled and studied in France, Italy and Germany, returning in 1601 to Amsterdam, where his father was Burgomaster. After writing the famous pastoral drama, *Granida,* 1605, he studied law at Leyden and soon after was made steward of Muiden, a post he held for 40 years. Meanwhile he had become fascinated by the possibilities of historical research and started a series of historical works upon which he was to spend the rest of his life. The most important are the *History of the House of Medici,* 1638, and *History of the Low Countries,* 1642. Dutch literature owes to Hooft its introduction to classical and Renaissance Italian influences, and historians such as Motley admit their indebtedness to him. Hooft died at The Hague, May 21, 1647.

HOOGLY, also Hooghly and Hugli, a river of India, one of the arms by which the Ganges empties into the Bay of Bengal. The total length of the Hoogly is 200 mi. The waters of the delta of the Hoogly are held sacred by Hindus. The stretch of the river between Calcutta and the delta is open to navigation.

HOOKER, JOSEPH (1814-79), American soldier, was born at Hadley, Mass., Nov. 13, 1814. He graduated in 1837 at West Point and served in Florida and in the Mexican War. At the outbreak of the Civil War, he was appointed brigadier-general of volunteers, becoming major-general in May, 1862. He showed great skill as commander and took part in the battles of Williamsburg, second battle of Bull Run, Chantilly, Antietam and Fredericksburg. President Lincoln appointed him, in 1863, to command the Army of the Potomac which he completely reorganized and equipped, but after his disastrous encounter with Lee at Chancellorsville he resigned this command, June 28, 1863. In November of the same year, in command of two army corps, he won the "Battle of the Clouds" on Lookout Mountain, and served with Sherman in the Atlanta campaign. In March, 1865, he was brevetted major-general in the regular army. He retired in 1868 with full rank of major-general, Oct. 15, 1868. General Hooker died at Garden City, L.I., Oct. 31, 1879.

HOOKER, SIR JOSEPH DALTON (1817-1911), English naturalist, was born at Halesworth, June 30, 1817. In 1839 he joined Sir James Ross's Antarctic Expedition in the Erebus and Terror and made the first accurate survey of the flora of the Antarctic. In 1848 he visited India, and from 1865 to 1885 he was director of the Kew Botanical Gardens, London, making frequent scientific trips to various parts of the world. Hooker was an authority on plant geography and published a number of works (*Flora Antarctia, Flora of British India*) upon both the facts and problems of plant distribution on the earth, publishing with G. Burtham the great *Genera Plantarum.* He devoted much attention to questions of the origin and development of plants and was instrumental in persuading DARWIN to publish his theories upon the development of species. He was knighted in 1877 and died at Sunningdale, Dec. 10, 1911.

HOOKER, RICHARD (c. 1553-1600), English divine and theological writer, was born at Heavitree, Exeter, England, about 1553. He was graduated from Corpus Christi College, Oxford, in 1574, and received a Fellowship there in 1577. After his ordination in 1581 he served as rector of Drayton-Beauchamp in Buckinghamshire, Master of the Temple, prebendary of Salisbury, and rector of Boscombe, near Amesbury, where he wrote his great work, *Of the Laws of Ecclesiastical Polity.* He died Nov. 2, 1600, at Bishopsbourne, where he was rector for five years.

HOOKER, THOMAS (1586-1647), American theologian, was born on July 7, 1586, at Marfield in Leicestershire, England. He studied at Cambridge, and graduated in 1611. After holding a fellowship at Cambridge for several years, he obtained a parish in Surrey, and in 1626 began a series of lectures at Chelmsford in which he preached the morality of the Puritans. Coming under the displeasure of Archbishop LAUD, who placed Hooker under bond in 1629, he was summoned to come before the Court of High Commission in 1630, but escaped to Holland, whence he removed in 1633 to the Massachusetts Bay Colony. There he was pastor in the Puritan parish of Newtowne, where the people were called "Mr. Hooker's Company." He led the band of Puritans which founded Hartford, Conn., in 1636, and was a guiding spirit in framing the laws and guaranteeing the rights of the individual citizen. Hence, he is called "the father of American democracy." He adhered firmly to the principle that not only do the people have the right to elect their governors, but also to limit the powers of those whom they elect. He held his pastorate at Hartford until he died on July 7, 1647.

HOOKE'S LAW. *See* ELASTICITY.

HOOKWORM DISEASE. The hookworms are a group of small round worms, about 7 to 15 mm. long, which pass most of their lives in the intestine of various mammals and a part of their larval stages in the soil. Three hookworms are of importance to man: *Necator americanus,* the so-called American hookworm, and *Anchylostoma duodenale,* the so-called European hookworm, both of which produce hookworm disease, and *Anchylostoma braziliense,* primarily a parasite of dogs and cats, which does not com-

plete its life-history in man but will live in the human skin where it produces "creeping eruption." Besides these there are various hookworms belonging to divers genera and producing diseases of domesticated animals.

The adult worm of *N. americanus* and *A. duodenale* attaches itself to the mucosa of the intestine where it actively sucks blood. The sexes are separate and after copulation the females lay enormous numbers of eggs which pass out of the body with the feces. If these find suitable conditions, they hatch and develop larvae which becomes infective in about a week under optimal conditions. These, when they come in contact with skin, penetrate, giving rise to a condition known as "ground itch." Eventually, they reach the blood stream, are filtered out in the capillaries of the lungs, crawl through the air spaces to the trachea and reach the mouth, where they are swallowed, and so, reach the intestine, where they grow into adult worms. The development of *A. braziliense* is similar in the natural host, but when it penetrates human skin, the larva seems unable to complete the migration to the digestive tract and remains in the vicinity of the skin. Since the free-living stages of the parasites require a mild environment, these infections are widespread only in tropical and subtropical countries and in certain mines of colder climates, where temperature and moisture conditions are favorable.

The severity of hookworm disease depends largely upon the number of worms harbored. In moderate cases there is anemia, exaggerated appetite, circulatory disturbances and general malaise. In children growth and mental development are greatly retarded, and in adults any physical exertion is undertaken only with great effort. A number of drugs will remove hookworms from the intestine.

Control of hookworm disease has been undertaken in many countries, including the Southern United States. Among the methods used should be mentioned treatment of cases, education to secure proper disposal of human excreta so that the soil will not become infected, and the wearing of shoes which prevents the direct contact of the skin with infected soil. Besides conscious control measures, hookworm disease tends to disappear with the general rise of living standards, since these automatically tend to eliminate various factors necessary for the life cycle of the parasite and for the infection of human beings. *See also* PARASITIC DISEASES; TROPICAL MEDICINE.

W. H. TA.

HOOPESTON, a city in Vermilion Co., eastern Illinois, situated 100 mi. south of Chicago. It is served by two railroads. The city is a shipping point for grain and live stock. The leading industries are the production of chemicals, canned goods and iron. Pop. 1920, 5,451; 1930, 5,613.

HOOPOE, the common name for a family (*Upupidæ*) of over 30 species of rather small Old World birds so named in imitation of their soft peculiar call. They belong to the order of roller-like birds and are most closely allied to the hornbills. The European hoopoe (*Upupa epops*), the best known species, is found widely in Europe, Asia and north Africa. It is about the size of a large thrush, with handsome cinnamon-colored plumage, variegated with black, buff and white, a splendid crest on the head and a long, slender, downwardly curved bill. Terrestrial in habit it usually



EUROPEAN HOOPOE

frequents open country, feeding on grubs and other insects, for which it probes in the ground with its bill. The hoopoe nests commonly in a cavity in a tree where the female sits closely, incubating 5 to 7 eggs, and is fed by the male. In southern Europe its flesh is highly esteemed for food.

HOOVER, HERBERT CLARK (1874-), 31st President of the United States, born at West Branch, Ia., on Aug. 10, 1874, the son of Jesse and Hulda Hoover. His maternal ancestors, the Minthorns, landed in Boston in 1725, and his first American forebear lived in New England—William Minthorn, his great-great-greatgrandfather. The entire family was Quaker in religion. When the Revolutionary War came, the Minthorns, shunning strife, made for the interior, eventually stopping in 1858 in Iowa near West Branch. Four years earlier Jesse Hoover, grandson of Andreas Huber, a Swiss German immigrant in 1739, and grandfather of Herbert's father, had founded the town of West Branch. On Mar. 12, 1870, Jesse Hoover had married Hulda Minthorn while he was a blacksmith and she was minister of the Springdale Friends' Assembly. Besides Herbert, there were two other children, Theodore and May.

When Herbert was six years old Jesse Hoover died, leaving Hulda Hoover to support the family by sewing and preaching at Quaker meetings. From 1881-84 Hoover attended grammar school, and began to develop the interest in geology which later culminated in his life work as a mining engineer. In 1884 death took his mother, and he was taken by his uncle, Allan Hoover, for a year and a half on a farm. His uncle, John Minthorn, having gone to settle on the Willamette River in Oregon, suggested that Herbert might come to stay with him, where he could attend the Friends' Pacific Academy. In 1885 Hoover made the long journey across the plains to

Newberg, Ore. There he went to school and did chores for his uncle in return for his keep for three years. At 14 he went with Minthorn to Salem, and served as office boy for the Oregon Land Co. There, efficiently and versatilely, he worked until one day a mining engineer came into the office to talk about geology; when he left Herbert Hoover had decided to be a mining engineer. Hearing that Prof. J. C. Branner was to be at the new university at Palo Alto, Cal., Hoover decided to go to Stanford. He enrolled in 1891 in mechanical engineering, not without considerable trouble in preparing for the entrance examinations. During the summer vacations of his college years he worked first under Prof. Branner, head of the department of Geology, and then under Waldemar Lindgren, the prominent mining engineer.

Graduating from Stanford in 1895, Hoover found it hard to secure the sort of position he wanted, and was forced to work as a laborer for six months or more. At last he went to see Louis Janin, a consulting mining engineer, and was given a job in his offices in San Francisco. Having convinced Janin of his worth, Hoover in 1896 had obtained a salary of $3,000 a year. At 22 years of age he was put in charge of a mine at Carlisle, N.M., where he directed all the work of development, production and personnel management. In 1898 he went to Australia as mining engineer for an English company, and developed the gold mines of the southwestern part of the continent with such success that his name was known wherever mining engineers met to discuss their common problems. At this time he was offered the position of Director-General of Mines in the newly organized government of China. Having accepted, Hoover traveled to London, across the United States to San Francisco, and then to Monterey where he married Lou Henry, a student at Leland Stanford during his university days. In Feb. 1899 they embarked for Tientsin, China.

In the northern part of China Hoover located the largest deposits of coal yet found, and substituted for the ancient methods of mining it, the modern ones in use in the United States. He and Mrs. Hoover were in grave danger at Tientsin during the Boxer Rebellion of 1900. From 1901-13 he was employed in mining operations in Australia, Burma, Russia, Italy and Central America, and had offices in New York, San Francisco and London. During this period two sons, Herbert and Allan, were born to the Hoovers. In 1909 he published his *Principles of Mining,* and in 1912 the translation, done with Mrs. Hoover, of Agricola's *De Re Metallica,* a Latin work published in the 16th century.

In 1914 Hoover was in Europe as envoy of the Panama Pacific Expedition to arrange for the participation of European nations. When the World War broke out he was informed that 150,000 Americans were stranded because their instruments of credit were irredeemable for cash. Hoover enlisted several engineer friends in an organization which provided the necessary funds on the personal security of the needy persons. The association even arranged for the means of transporting the travelers to the United States. In the midst of this philanthropy Hoover was called to organize a vast relief project for the occupied regions of Belgium and France. Throughout the war he directed the relief measures, constantly hampered by diplomatic troubles with Germany, which supplied France and Belgium with 5,000,000 tons of necessities valued at $1,000,000,000. Famous for this great organized effort, Hoover was appointed Food Administrator by President Wilson. He secured the cooperation of the entire American nation in conserving the food supply, and even succeeded in arranging the observance of meatless and wheatless days. The responsibility of maintaining the great armies of the Allies and the civilians as well largely rested on the United States, the very continuation of the war depended partly on the amount of food that conservation could insure to the allied combatants after Apr. 1917. To carry out the conservation program Hoover set up the National Grain Corp., the Sugar Equalization Board and the Food Purchase Board.

After the Armistice in Nov. 1918, Hoover became head of the Supreme Economic Council, and was chairman of the American Relief Administration, which furnished a vast amount of food to suffering peoples, especially those of eastern Europe. With the dissolution of the latter organization at the ratification of the Versailles Treaty he formed the European Children's Fund to relieve the suffering of 8,000,000 underfed and diseased children in eastern and central Europe, furnishing them with food and clothing.

He had unorganized support in the Republican Convention for the Presidency in 1920, but was chosen Secretary of Commerce in Harding's Cabinet in 1921. In this capacity his first task was the reorganization of the department and the inclusion in it of the Patent Office and the Bureau of Mines. He campaigned against monopoly prices of coffee, nitrate and potash; united manufacturers in a voluntary cooperative program to eliminate waste in industry; directed the conference on unemployment in 1921; presided over the St. Lawrence Waterways Commission; served on the debt commission which funded international debts and on the advisory committee of the Washington Arms Conference; and presided at the international radio conference. In 1921-23 he organized relief measures for 10,000,000 famine-stricken Russians along the Volga River, while in 1927 his organized flood relief, which incorporated army, navy, Red Cross, and civilians, brought incalculable aid to the sufferers along the Mississippi and its tributary rivers.

Without his consent Hoover received 334 votes as a vice-presidential nominee at the Republican convention of 1924, the nomination going to Dawes. However, at the convention of 1928, Hoover was nominated for President on the first ballot with 837 of 1,089 votes. In the election of the same year he

was elected by 444 electoral votes out of 531 and by a popular vote of 21,500,000 to 15,000,000 for ALFRED E. SMITH. In the voting Hoover managed to break the SOLID SOUTH, carrying Florida, North Carolina, Texas and Virginia, but lost Rhode Island and Massachusetts, always Republican strongholds.

Soon after the election the President-elect visited the Latin-American republics in Central and South America, returning in Jan. 1929, the month of the Kellogg Pact. His first administration year was marked by his appointment of the Wickersham commission to investigate law enforcement; the passage of the farm relief bill; the revision of the tariff; the utterance of the freedom of the seas doctrine for merchant ships in time of war; and the expansion of the merchant marine. In 1930 the President encountered considerable opposition in the Senate but had strong support in the House. He vetoed the Spanish War Veterans' Bill and opposed Government operation of Muscle Shoals. On the other hand he saw his 15-year plan of waterway improvement begun and the Prohibition enforcement agents transferred from the Treasury to the Department of Justice; he appointed a drought relief committee, a National Advisory Committee on Education, a Federal Power Commission and a Federal Radio Commission; he persuaded Congress to appropriate more funds for the Federal Farm Board and more money for the construction of public works; he was very influential in checking the competition between the United States, Japan and Great Britain in shipbuilding, and called the conference at Washington on Child Health and Protection. In this year OWEN D. YOUNG drew up his famous plan for the payment of reparations and the settlement of international debts.

In 1931, when the panic of 1929 had reached its height, President Hoover was faced by a Congress with party votes almost evenly divided. In spite of this, the administration began a series of unemployment and other relief bills. Hoover again vetoed the veteran's bonus loan bill but it was passed over his veto; he also vetoed the Muscle Shoals bill, and was sustained. In order to alleviate somewhat the drastic turns the economic situation had taken, the President conferred with industrial leaders, with labor union leaders, with railroad magnates and with bankers in an attempt to persuade them to cooperate in the Federal measures for national relief. At this time President Hoover proposed the one-year moratorium for European debts, and arranged for a national organization for the relief of the unemployed, appointing Walter S. Gifford its head. Government foreign policy in 1931 was marked by a hesitant cooperation of the United States with the League in the Manchurian crisis and by the conferences between President Hoover and the French Premier Laval and the Italian Foreign Minister Grandi on financial matters. At the end of the year 1931 the Democratic majority party in the House agreed to hasten needy legislation. Early in 1932 the United States Government joined the Governments of Great Britain, France and Italy in proposing to China and Japan a plan for the settlement of the Manchurian crisis and the hostilities growing out of the Japanese occupation of Shanghai. President Hoover also turned his attention to a comprehensive program to combat the depression. He began the organization of the activities of the National Credit Corporation and the Reconstruction Finance Corporation, both created by act of Congress, and launched a drive to prevent the hoarding of money which he asserted was one of the principal factors retarding the nation's economic recovery. Hoover was renominated for President at the Republican Convention in June, 1932, but was not reelected in November. S. D. F.

See W. Irwin, *Herbert Hoover, A Reminiscent Biography.*

HOOVER DAM located on the Colorado River in the states of Arizona and Nevada will be, when completed, the highest dam in the world and will contain the greatest amount of concrete of any dam. It will be a gravity type structure, 727 feet high from lowest point of foundation to the top, and 600 feet high above the bed of the stream. Built in the form of an arch of 500 feet radius, it will be 1180 feet long on top, will have a maximum thickness of 650 feet at the base, and will contain 3,407,000 cubic yards of concrete. It will create a storage reservoir more than 100 miles long, holding 1328 billion cubic feet of water, or approximately two years' flow of the river. This great storage capacity will serve the combined purposes of flood-control, water supply for irrigation and domestic consumption, and power development. The dam is of the non-overflow type and excess flood waters will be discharged through two tunnels of 50 feet diameter excavated through the rock wall of the canyon. Two more tunnels of the same diameter will pass water for irrigation as needed, the flow to be controlled by outlet works built into the canyon walls. The power house will be a U-shaped structure, 1000 feet long, at the base of the dam and contain machinery of more than a 1,000,000 hp. F. K.

HOP (*Humulus Lupulus*), a twining perennial of the MULBERRY family native to Europe and Asia and widely naturalized in North America. In Europe the plant has been cultivated since early medieval times for its resinous leafy flower clusters, which, when properly gathered and dried, form the hops of commerce, used chiefly in brewing. The earliest mention of hop gardens is found in a document executed by Pepin in 768. The cultivation of the hop was established in England in 1525 and in the United States in 1629. Hops are grown in large quantities in various parts of Europe, especially in England. In the United States Oregon, California, New York and Washington lead in production.

HOPE, a city in Hempstead Co. in southwestern Arkansas, situated about 120 mi. southwest of Little Rock. The Missouri Pacific, Louisiana and Arkansas and the Frisco railroads serve the city. There also is an airport. Cotton, corn and watermelons are the principal crops of the region. Hope is a shipping point and an industrial center for the manufacture of

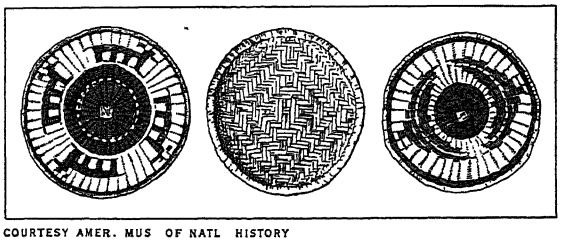
cotton, cottonseed and lumber products, fertilizers and bricks. The city is incorporated. Pop. 1920, 4,790; 1930, 6,008.

HOPE THEATER, an Elizabethan playhouse used also as a beer garden, on the Bankside, Southwark, London. Built by Philip Henslowe and Jacob Meade in 1613, it was razed in 1656.

HOPEWELL, an industrial city in Prince George Co., southeastern Virginia, situated at the confluence of the Appomattox and James rivers, 18 mi. south of Richmond. Steamships, the Norfolk and Western and the Seaboard Air Line railroads afford transportation. Hopewell is a trade market for farm products. The chief manufactures are paper, rayon, anhydrous ammonia, synthetic nitrate of soda, pottery and dogwood products. In 1929 the retail trade amounted to $3,720,221. Pop. 1920, 1,397; 1930, 11,327.

HOP-HORNBEAM (*Ostrya virginiana*), a small tree of the birch family, called also ironwood. It is widely distributed in gravelly woods in eastern North America. The tree grows usually from 20 to 30 ft. high with long slender drooping branches forming a round-topped head. The tough branchlets bear oblong, sharply toothed leaves and a hoplike fruit composed of membranous scales enclosing several small nuts. The hard durable wood is used for making tool handles and similar small articles.

HOPI or **MOKI,** a North American Indian tribe, of the Pueblo group, inhabiting eight small towns in northeastern Arizona and speaking a dialect of the Shoshonean linguistic stock. The modern villages are Walpi, Sichumovi and Hano, which differs in being Tewan, on the eastern or first mesa; Shipaulovi, Mishongnovi, Shumopovi on the middle or second mesa; and Oraibi and Hotavila on the third mesa, the latter recently established as the result of a schism



COURTESY AMER. MUS OF NATL HISTORY

BASKETWORK OF THE HOPI INDIANS

between the conservative and progressive groups in the tribe. The Hopi were discovered by the Spaniards in 1540 and were converted to Catholicism as early as 1629, but as always among the Pueblos, this conversion overlies the aboriginal ceremonial, religious and social structure. Following the Pueblo revolt in 1680, all the Hopi towns were moved up on the mesas to facilitate defense. Living far to the west of the center of Spanish influence, the Hopi have succeeded in retaining their original customs to a greater extent than the more easterly Pueblos. They live in terraced houses set high on the mesas, depend for food chiefly on agriculture, and raise cotton, which is prepared and woven by the men. They maintain a matrilineal clan system and numerous ceremonies, the best known of which is the SNAKE DANCE.

HOPKINS, B. SMITH (1873-), American chemist and educator, was born at Owosso, Mich., Sept. 1, 1873. He graduated from Albion College in 1896 and took his Ph.D. at Johns Hopkins in 1906. Hopkins was teacher, principal and superintendent of



COURTESY AMER MUS. OF NATL. HISTORY

DAILY LIFE OF THE HOPI MESA DWELLERS OF ARIZONA

schools in Menominee, Mich., 1897-1904; then served as professor of chemistry at Nebraska Wesleyan University, 1906-09, and at Carroll College, 1909-12. In the latter year he went to the University of Illinois, becoming professor of inorganic chemistry in 1923. He and his colleagues discovered the element illinium.

HOPKINS, ERNEST MARTIN (1877-), American educator, was born in Dunbarton, N.H., Nov. 6, 1877. He graduated in 1901 at Dartmouth where he served as secretary to the president until 1905 and for the five succeeding years as secretary of the college. From 1910-16 Hopkins was employed in reorganization work for industrial firms in Boston, Philadelphia and Chicago, and in 1916 returned to Dartmouth as president. He was given a leave of absence in 1918 to act as assistant to the Secretary of War in charge of industrial relations.

HOPKINS, ESEK (1718-1802), American naval officer, was born in Scituate, R.I., in 1718. He had spent thirty-seven years at sea when in 1775 he was chosen by the Continental congress as commander-in-chief of the new American navy. The next year he captured a British naval base in the Bahamas. His subsequent unsuccessful encounter with the British *Glasgow* caused his dismissal in 1777. He died at Providence, R.I., in 1802.

HOPKINS, JOHNS (1795-1873), American philanthropist, was born in Anne Arundel Co., Md., May 17, 1795. He entered the grocery business, founding in 1822 the house of Hopkins & Brothers. In 1847 he engaged in banking and railroad enterprises. He gave property for the foundation of a free hospital which bears his name in Baltimore; presented

the city with a public park; and made possible the foundation of Johns Hopkins University. At his death in Baltimore, Dec. 24, 1873, he left further endowments to the university and the hospital.

HOPKINS, MARK (1802-87), American educator, was born at Stockbridge, Mass., Feb. 4, 1802. Graduating from Williams College in 1824, he tutored there for two years and then studied at the Berkshire Medical College, graduating in 1829. He was about to begin practice in New York when he was called to the chair of moral philosophy at Williams. In 1836 he became president of Williams, serving in this office for 36 years, and continuing to hold the chair of moral philosophy until his death. It is not as an educational theorist nor an educational reformer that Hopkins stands out as a prominent figure in education, as is the case with other educators of his time. Rather it was his personal contact with his students in and out of lecture room, his forcing them to develop a keen perception and clear thinking, that made him outstanding. He died at Williamstown, Mass., June 17, 1887. In 1915 Hopkins was elected to the Hall of Fame.

Among his writings are *The Influence of the Gospel in Liberalizing the Mind,* 1831, *The Evidences of Christianity,* 3rd ed., 1875; and *An Outline Study of Man,* last ed., 1893.

HOPKINSON, FRANCIS (1737-91), American lawyer and publicist, was born at Philadelphia, Pa., on Sept. 21, 1737. He received his education at the College of Philadelphia, and was admitted to the bar in 1761. He began practicing in Philadelphia, but later moved to New Jersey. As their representative he was sent to the Continental Congress. He was a member of the committee which drafted the Articles of Confederation, and was one of the signers of the Declaration of Independence. He held several federal offices, and was an admiralty, and a district judge in Pennsylvania. He studied the harpsichord and organ, and his song, *My days have been so wondrous free* (1759), is probably the earliest existing American secular composition. He died at Philadelphia on May 9, 1791.

HOPKINSON, JOSEPH (1770-1842), American jurist and writer, son of FRANCIS HOPKINSON, was born at Philadelphia, Pa., Nov. 12, 1770. He graduated from the University of Pennsylvania, studied law and became a leading jurist. He defended Judge Chase before the Senate, and was Federalist representative in Congress from 1815-19. As United States district judge for Pennsylvania from 1828 until his death, his decisions carried great authority. Hopkinson's popular fame, however, rests upon his national anthem, *Hail Columbia,* composed in 1798. He died at Philadelphia, Jan. 15, 1842.

HOPKINSVILLE, a city of southwestern Kentucky, the county seat of Christian Co., situated about 100 mi. south of Evansville, Ind. The Louisville & Nashville, Illinois Central and Tennessee Central railroads, as well as bus and truck lines, provide transportation. The Renshaw Airport is here. Hopkinsville is a tobacco, grain and live stock market, and has diversified manufactures, including tobacco products, flour and clothing. Bethel Woman's College is in the city. Hopkinsville is the birthplace of JEFFERSON DAVIS, an event that is commemorated by the Jefferson Davis Memorial, a concrete monument 10 mi. east of the city. The incorporation date was 1870. Pop. 1920, 9,696; 1930, 10,746.

HOPPER CAR. *See* RAILROAD ROLLING STOCK.

HOP-TREE (*Ptelea trifoliata*), a small tree of the rue family, known also as wafer ash and shrubby trefoil. It is found widely in rocky woods in the eastern United States and Canada and is frequently planted for ornament. The tree grows from 10 to 25 ft. high, with a slender trunk and small spreading branches bearing dark green shining leaves of 3 or sometimes 5 leaflets and small, greenish-white, unpleasantly scented flowers. The dry, flat, orbicular, very bitter fruits (samaras), borne in dense drooping clusters, have sometimes been used as a substitute for hops.



P. A. RYDBERG, "FLORA OF PRAIRIES AND PLAINS"

HOP-TREE OR WAFER ASH

HOQUIAM, a port city in Grays Harbor Co., western Washington, situated at the mouth of the Hoquiam River on Grays Harbor, an inlet of the Pacific Ocean. The city lies on the south of the Olympic Peninsula, which has magnificent forests, lakes and mountains. Ocean liners, bus and truck lines and three railroads serve Hoquiam. The Olympic Highway is the principal thoroughfare. There is an airport. The city is a market and shipping center for lumber, furniture, dairy products, poultry, berries, and hay; lumber is the chief export. The port of Grays Harbor which borders on Aberdeen as well as on Hoquiam has the largest lumber shipping trade in the United States. The city has huge sawmills and lumber products mills, veneer factories, pulp and paper mills and other industrial plants. In 1929 the manufactured output was worth about $17,000,000; the retail trade amounted to $5,563,308. Hoquiam was founded on the site of an Indian village in 1882 and incorporated in 1889. Pop. 1920, 10,058; 1930, 12,766.

HORACE (65-8 B.C.), celebrated Roman poet, whose full name was Quintus Horatius Flaccus, was born at Venusia in 65 B.C. At an early age he was taken to Rome, where he received a thorough education, carefully supervised by his father, a freedman. To complete his studies, he went to Athens about 45 B.C. There, following the assassination of JULIUS CAESAR, he joined the republican army being organized by BRUTUS, and served as a military tribune in the defeat at Philippi. Returning to Rome, he earned a livelihood as a quaestor's clerk for a time. His natural bent was toward literature, however, and

soon he was composing poetry that won the admiration of Vergil and Varius, both of whom became his intimate friends. They introduced him to the patron of letters, MAECENAS, and through the latter's material aid, Horace was enabled thenceforth to devote his entire time to poetry. From Maecenas he received the famous Sabine estate. Horace was one of the most popular figures of the Augustan Age, and his friends included the Emperor AUGUSTUS himself. He died at Rome, Nov. 27, 8 B.C.

The poetic works of Horace are divided into *Odes, Epodes, Satires* and *Epistles*. Of the latter, the *Epistula ad Pisones,* commonly called the *Ars Poetica,* is the most famous. In Horace we do not find the lofty flights of imagination of PINDAR and SAPPHO, whom he frequently used as models, or the philosophic depth of LUCRETIUS, or the mysticism of his friend VERGIL. But Horace fully realized his own limitations, and wisely refrained from overstepping them. His qualities are to be found in his calm reflection, his simple and lucid thought, and his finely wrought expression, which have made him the most quotable of Latin poets. He was a master of satire, keenly aware of human frailty, but his irony is good-natured and bantering, not bitter like that of JUVENAL. An Epicurean, he found in serenity and temperance the means of enjoying life. Next to Vergil, Horace ranks as the greatest of Roman poets; he is probably the most widely read and enjoyed of all. *See also* LATIN LITERATURE.

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HORAE, in Greek mythology, the goddesses of the seasons, daughters of ZEUS and Themis. At Athens only two are mentioned by name, Thallo and Carpo; but usually they are known as three, Eunomia (good order), Dike (justice) and Eirene (peace). They controlled the changing weather and were protectors of the crops. The graces and nymphs were associated with them. They are represented as beautiful maidens.

HORATIUS COCLES, ("One-eyed Horatius"), a hero celebrated by Macaulay in his poem, "Horatius at the Bridge," in the *Lays of Ancient Rome,* published 1842. Horatius is one of the three companions who defended the bridge over the Tiber against the attacks of Lars Porsena, 507 B.C.

HOREHOUND (*Marrubium vulgare*), a white-woolly, bitter-aromatic, perennial herb of the mint family, used extensively in confections and in medicine. It is a native of the Old World, very widely naturalized as a weed across North America. The plant grows about 2 ft. high with widely branched stems bearing wrinkled, more or less toothed leaves and whitish flowers in dense whorled clusters.

HORIZON, in astronomy, that great circle in the heavens that divides objects visible at a given instant from those that are invisible. Its plane is perpendicular to the direction of the force of gravity.

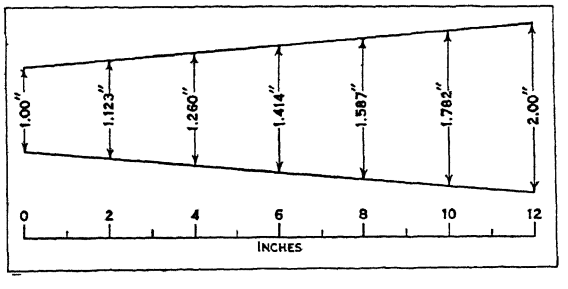
HORIZONTAL BAR, an adjustable, strong and smooth crossbar of wood, held up by two iron uprights. Exercises on this apparatus are divided into two classes: those for the low, or chest-high horizontal bar, and those for the high horizontal bar. In the former category the bar is adjustable to a height of between 3 and 5 feet, depending upon the stature of the students. Exercises include underswings, circles, leg swings, glide swings, high circles and vaults. Exercises for the high horizontal bar, at a height of between 6 and 8 feet, include kips and swing-ups, swing stems and giant swings. *See also* PHYSICAL TRAINING.

HORMISDAS, pope from 514-523, healed in 519 the breach which had existed between the Eastern and Western churches since 484.

HORMONES. *See* BIOCHEMISTRY.

HORN, PAUL WHITFIELD (1870-), American educator, was born at Booneville, Mo., Apr. 30, 1870. He was graduated from Central College, Fayette, Mo., 1888, and taught in the schools of Tennessee and Texas until 1897. He was superintendent of schools at Sherman, Tex., 1897-1904; at Houston, Tex., 1904-21; and of American schools at Mexico City, 1921-22. For a year he presided over Southwestern University, Tex., and in 1924, became president of Texas Technological College at Lubbock.

HORN, in acoustics, a flaring tube used with SOUND producers to increase the acoustic energy which a vibrating member imparts to the air; also used in sound recorders to increase the motion which sound waves impart to a vibrating member. It thus functions as an acoustic coupling between a vibrating diaphragm and the air. As used in PHONOGRAPHS, megaphones and LOUD SPEAKERS, the vibrating member is placed at the small end. Due to the confined space in which the vibrator acts, its motion produces larger pressure changes than if it were vibrating freely in the open air. In the ideal case, these pressure changes would be transmitted undiminished to the open end, where they would be imparted over the larger area of the opening to the free atmosphere. The effect of the sound energy radiated is thereby increased.



CONTOUR OF EXPONENTIAL HORN THAT DOUBLES ITS RADIUS FOR EACH FOOT OF ITS LENGTH

The *conical horn* radiates feebly all tones lower than its lowest natural FREQUENCY, and it radiates most powerfully tones whose frequencies are approximately multiples of this lowest, or fundamental, fre-

quency. Its low-frequency response and uniformity of response at higher frequencies both improve with increasing length.

The *exponential horn* is a tube whose cross-section increases according to the formula,

$$S = S_1 e^{ml}$$

where S_1 is the section at the small end, S the section at a distance l from the small end, e the base of the natural system of logarithms, and m a constant. The cross-sectional area doubles at equal intervals along the length of the horn, this interval of length being inversely proportional to the value of m. A simple working rule for plotting the contour of an exponential horn that doubles its radius in any given length is the following:

$$\log_{10} \frac{R}{Ro} = \frac{l}{L} \log_{10} 2$$

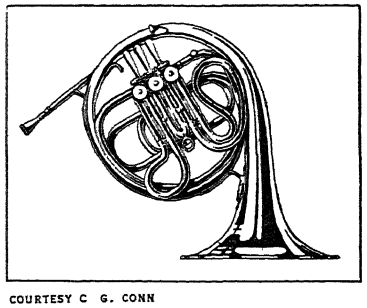
where R and Ro are two radii of the horn separated by the length l, and L is the length in which the radius doubles.

The advantage of the exponential horn over the conical horn of the same length lies in the fact that, if properly designed, the former has a better low-frequency response and is, accordingly, less selective.

P. E. S.

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HORN, a musical wind instrument belonging to the brass choir of the ORCHESTRA, sometimes known as the French horn to distinguish it from an entirely different instrument called the English horn or *cor anglais.* In its physical aspect it is a coiled brass tube, 7⅓ feet in length, terminating in a large "bell"; it usually is fitted with an additional length of tubing called the F-crook which makes it a transposing instrument sounding a fifth lower than the notes written. Its audible compass extends from B′ to f′′ (*see* OCTAVE and PITCH for an explanation of this terminology) while its written compass is a fifth higher. Less powerful than the trombone, it nevertheless boasts a tone of considerable volume when played *forte,* and at the same time is able to produce a tone of extraordinary mellowness and sweetness when played *piano.* It is the most versatile wind instrument among the brasses.



COURTESY C. G. CONN

FRENCH HORN

HORN, the bony or other firm protuberances on the heads of certain animals, commonly used for offense or self protection. They vary greatly in size, shape and position, ranging from graceful antlers of the deer to the short, massive horn of the rhinoceros. The character of horns of domestic animals has been influenced greatly by selective breeding and cross-breeding, with the result that horns of certain types have become breed characteristics, e.g., shorthorn cattle, and in some instances have been bred away entirely. Breeds which have thus been rendered hornless are commonly designated "polled" to distinguish animals of the breed from individuals that have been artificially dehorned.

Throughout history, horns from animals have served innumerable purposes, decorative, utilitarian, and military. Their use ranges from the costumes of witch doctors to containers for the powder of patriots and pioneers. Filled with oil and provided with wicks, horns have served as lamps. Used formerly as a signal in the hunt, horns have impressed their name on many other sound and musical devices.

As a by-product of the livestock and meat packing industry, horn continues to find new and valuable uses. Through ingenious processes, horn can be split, bent, or pressed into varied shapes, resulting in handles for cutlery and umbrellas, buttons, pipe stems, combs, dice, hairpins, and similar small articles. Horn can also be colored to resemble tortoise shell and by other processes is readily converted into GLUE, GELATIN, tankage, or FERTILIZER.

D. S. B.

HORNADAY, WILLIAM TEMPLE (1854-), American zoölogist, was born at Plainfield, Ind., Dec. 1, 1854. From 1875 to 1879 he traveled widely in the tropics as a collecting zoölogist and acted as chief taxidermist for the United States National Museum from 1882 to 1890. For the following six years he engaged in the real estate business at Buffalo, N.Y., and from 1896 to 1926 was director of the New York Zoölogical Park. He was active in promoting game preserves, particularly for bison and elk, and in 1913 founded the Wild Life Protective Association. He is the author of *Our Vanishing Wild Life, The American Natural History, Two Years in the Jungle* and other books on animal life.



DRAWING BY GEORGE MIKSCH SUTTON

HORNBILL

HORNBEAM, the name applied to various trees with dense heavy wood, especially to certain trees of the birch family including the birch hornbeam (*Carpinus Betulus*) of Europe, and also the BLUE BEECH (*C. caroliniana*) and the HOP-HORNBEAM (*Ostrya virginiana*) of eastern North America.

HORNBILL, the name of a family (*Bucerotidæ*) of large Old World picarian birds, allied most closely to the hoopoes. They are remarkable for their strange

nesting habits and their enormous bills. There are about 70 species, found in Africa, southern Asia and the East Indies. In length they range from about 2 to 4 ft. and have usually large powerful wings and black and white or gray plumage. The huge bill is surmounted in many species by a very large casque like a second beak. Hornbills are mostly arboreal in habit and move in small companies, feeding chiefly upon fruits and insects. Selecting a hollow in a tree for a nesting site, the male walls up the entrance with the female inside leaving only a small hole through which to pass food. The female then incubates the eggs and broods the young, the male supplying her with food.

HORNBLENDE, the common member of the AMPHIBOLE group of rock-forming minerals. It is a complex silicate containing calcium, magnesium, iron, sodium and aluminium, and corresponds in general to augite of the PYROXENE group, from which it may be formed by METAMORPHISM. It is found in igneous and metamorphic rocks, such as granite and schist.

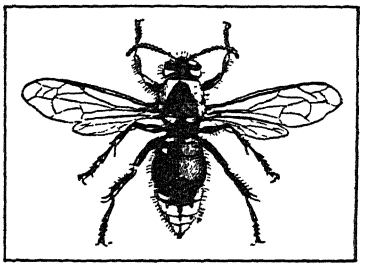
HORN-BOOK, a primer used in England before printed books taught children the elements of reading. It consisted of a thin wooden frame, having a leaf of transparent horn in front, so constructed as to hold a single sheet of parchment or vellum, on one side of which appeared the alphabet, and on the other usually the Lord's Prayer, the Creed and the Roman numerals. The horn-book was used in certain parts of England as late as the 18th century.

HORNED POUT, a name often applied to the common BULLHEAD, a small fresh-water food fish widely distributed in sluggish waters in North America. *See* CATFISH.

HORNED TOADS, called also horned lizards, harmless reptiles recognized at once by their crown of sharp horns, spiny back, short neck and tail, and broad, flattened body. These inguanid lizards exhibit great diversity in structure, some 17 species being recognized in the genus, *Phrynosoma.* Distributed over much of the southwestern United States and northern Mexico, they are at home in dry, arid country and especially in deserts. Their spiny form is thus in keeping with many of the surrounding plants and animals. Horned lizards are diurnal and viviparous (*P. cornutum* excepted) and subsist on spiders, flies, grasshoppers, ants and other small creatures. They have the disconcerting habit of squirting fine streams of blood from the eye when annoyed. The larger species attain a length of 7 to 8 in.

HORNELL, a city in Steuben Co., southwestern New York, situated on the Canisteo River, 57 mi. south of Rochester. It is served by bus lines and three railroads. There is an airport. Hornell is situated in a farming district which produces chiefly dairy products and potatoes. The city has various factories, turning out principally silk, furniture, wood-working products and electrical specialties, there are also railroad shops. The manufactured output of Hornell in 1929 reached a total value of $10,952,111. The retail business in 1929 amounted to $11,888,240. The city was founded in 1790 by George Hornell, and was called Upper Canisteo. In 1820 it was renamed Hornellville, which was changed to the present designation in 1906. The village was incorporated in 1852; the city in 1890. Pop. 1920, 15,025; 1930, 16,250.

HORNET, any species of wasp of the subfamily *Vespinæ* may be called a hornet. These insects have rather short, stout bodies. The "waist" connecting



WHITE-FACED HORNET
Vespa maculata

the thorax and abdomen is very short. In color they are black with spots or bands of yellow or white. All are social insects, which build paper nests. Two types of nests are made, one attached to trees or bushes, the other in the ground.

HORN-FLY, a two-winged fly of the family *Muscidæ,* very annoying to horned cattle. It resembles the house-fly, but is much smaller. When at rest, these flies cluster at the base of the horns or upon the backs of cattle. Eggs are laid in fresh manure, where the larvæ develop. Spraying the cattle with kerosene emulsion or crude petroleum will kill the flies. Fish oil is a good repellant.

HOROLOGIUM (gen. *Horologii*), the clock, an inconspicuous constellation between Eridanus and Columba. *See* STAR: *map.*

HOROSCOPE, a chart of the position of the sun, moon, stars and planets at the hour of birth, on the basis of which the chief traits and career of the individual are predicted. This is done by means of the ZODIAC, which is the part of the heavens containing the path of the sun, moon and principal planets. This was divided into 12 portions, called houses, each bearing the name of a prominent constellation.

Aries, or the Ram, is the first (Mar. 21 to Apr. 19), while the others bear such names as the Bull, Twins, Crab, Lion, Virgin, Scales, Waterman and Fish. With these are associated qualities and virtues, and again relations to the different parts of the body; for example, the Ram for the head, and the Bull for the neck. Similarly metals and colors were brought into the system, while the planets, according to their position, were assigned influences favorable or the reverse. Venus stands for the love life, Mercury for business affairs and the Scales for justice and thus lawsuits.

The practice of casting horoscopes or nativities dates back to remote ages, but has been elaborated in its revivals. Even a few centuries ago astronomers were required to cast horoscopes for royal patrons. *See* ASTROLOGY and ASTRONOMY.

HORSE, the common name for a modern domestic species (*Equus caballus*) of the family *Equidæ*. The term is also used for other members of the family, whose living representatives include the ass and the zebra. These animals are all members of the same genus (*Equus*) and so closely related that mating can take place between them.

If the horse were not an object of general interest because of his long and distinguished service to man, he would still deserve our attention from another point of view. A quite perfect developmental series of the skeletons of his ancestors, showing the evolution of the modern animal from a form quite different in character, has been unearthed. So different, indeed, was the earliest known Eocene equine that when it was found experts had no idea that it was a progenitor of the horse. It was called *Hyracotherium,* which means coney-like animal. Only when later fossil horses were found did its true nature become apparent.

The feet of the coney-like animal are not known, but its teeth show more of the cusplike development of omniverous feeders and are quite unlike the grinders of modern horses. Later horse-like animals had four toes on their front feet, three on their hind feet, and the nails were hoof-like in form. The first four-toed horse (*Eohippus*) was about the size of a fox terrier, 12 in. or 3 hands high, and on its hind feet were vestigial bones representing the lost fourth toe. Before the close of the Eocene Period, horses had increased some inches in stature, lost the vestigial bone of the fourth toe on the hind foot, and their molar teeth were becoming more like those of their modern descendants. In the Oligocene Period horses with only three toes on the front feet made their appearance. In all known cases the middle toes were the largest; they therefore bore most of the animal's weight. These horses were from 4½ to 6 hands high, and their molar teeth were still more like those of modern horses.

The next important advance occurred during the Miocene Period. At this time there developed horses (*Mesohippus*) in which only one toe touched the ground, the two side toes being present but too short to be of any use. Late in the Miocene the first one-toed horse (*Pliohippus*) emerged. It was about 10 hands high. Modern horses existed in the later Pliocene, and several extinct species of the same genus (*Equus*) have been found in Pleistocene deposits.

Some of the high points in the development of the horse have been merely indicated; it should be understood, however, that the known fossils are many, and that they show graphically not just a few general trends, but many minute steps in the evolution of modern horses, which stand up to 18 hands in height, and are perfectly adapted to make speed in open country, and to a grass diet, from a little creature only 3 hands high, which may have lived in wooded places, and subsisted on a variety of foods. That the evolutionary process is not yet completed is shown by the presence of the splint bones on modern horses. These are the useless vestiges of the second and fourth digits of their remote ancestors.

Prehistoric horses lived in both the Old and New Worlds. The coney-like animal was found in Europe, but the most complete series of skeletons has been discovered in America. Before historic times horses became extinct in North America, and probably also in South America, to be re-introduced by the white man.

The only true wild horse in the world to-day is the Mongolian pony (*Equus przewalskii*) found on the steppes of Asia, where it lives in herds, led by a stallion. There are good reasons for believing that it is not the ancestor of our domestic breeds, but rather a sort of first cousin. The ass and zebra might be called second cousins. A. I. W.

HORSE BOT-FLY, an insect pest of the family *Gastrophilidæ,* known also as the stomach bot. The adult fly resembles the honey-bee in its form. The end of the abdomen of the female is elongate and curved forward under the body. Eggs are laid usually on the long hairs on the inner side of the foreleg of the horse. If licked off by the horse and swallowed, they develop into larvæ. These fasten themselves by hooks to the inner coat of the stomach, remaining there until full-grown. They then pass from the animal with the dung, crawl to a protected place and pupate. The eggs may be shaved from the horse's legs, or removed with kerosene.

HORSE-CHESTNUT (*Æsculus Hippocastanum*) a large tree of the horse-chestnut family, native from Greece to the Caucasus and widely planted in Europe and America for shade and ornament. It grows sometimes 100 ft. high, with stout spreading branches, large leaves of about 7 radiating leaflets, and showy clusters of white flowers, blotched with red and yellow. The fruit is a prickly capsule containing large glossy brown nutlike seeds. The soft wood is utilized for various purposes; in many parts of Europe the bitter, starchy seeds are used as food for livestock and poultry. *See also* BUCKEYE.

HORSE LATITUDES, a term applied to the region along the polar edge of the trade-wind belts, which is a zone of high atmospheric pressure. Variable breezes with a preponderance of calms prevail. The term probably was applied to these zones because of the uncertain winds of these latitudes, although another explanation is that the calms of these zones kill the horses on a sailing vessel during a voyage.

HORSE MINT, the common name for plants of a genus (*Monarda*) of strongly aromatic herbs of the mint family. There are about 15 species all native to North America, chiefly east of the Rocky Mountains, a few of which are cultivated for their ornamental foliage and flowers. They are erect, usually tall annuals or perennials with large toothed leaves and conspicuous white, red, yellowish or mottled flowers borne in dense heads, mostly at the ends of branches. Among the best known are the Oswego-tea or bee balm (*M. didyma*), with handsome scarlet-red flowers about 2 in. long, and the wild bergamot

(*M. fistulosa*), with purple or purplish dotted flowers about an inch long, both of which are cultivated in numerous floral varieties. Various species yield thymol widely used in medicine.

HORSE-NETTLE (*Solanum carolinense*), a stout, spiny perennial of the nightshade family called also sand brier and radical-weed. It is native to dry soils from Vermont to Florida, and westward to Nebraska and Texas, sometimes becoming a pestiferous weed. The plant grows from 1 to 4 ft. high with the stem, branches and deeply lobed leaves armed with needle-sharp yellow prickles. The violet or sometimes white flowers, resembling those of the potato, are followed by smooth yellow berries.



COURTESY IOWA GEOL. SURV.

DOWNY HORSE MINT
Monarda mollis

HORSENS, a seaport city of Denmark, in Jutland, about 25 mi. southwest of Aarhus at the head of Horsens-Fjord. The city contains a monastery, a church dating from the 13th century, and a museum. Horsens is an active, industrial city, manufacturing textiles, engines, electrical apparatus, tobacco, soap and dairy produce. Cattle, butter and eggs are exported. Pop. 1930, 28,306.

HORSE-POWER, the rate of doing WORK. The unit of work commonly used by engineers is the foot-pound. It represents the amount of work done by a FORCE of one pound acting through a distance of one foot.

Using the heavy draft-horses of Barclay and Perkins' Brewery, London, JAMES WATT set them to raising a weight of 100 lbs. from the bottom of a deep well by pulling horizontally on a rope passing over a pulley. He found that a horse could maintain a speed of 2½ mi. an hr. at this work. This meant

$$2\tfrac{1}{2} \times 5{,}280 \times \frac{100}{60} = 22{,}000 \text{ ft.-lb. per min.}$$

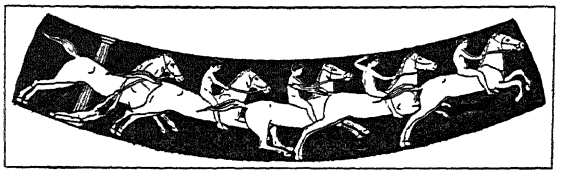
Allowing 50% extra for the work wasted in FRICTION, Watt arrived at a value of 33,000 ft.-lb. per min. for the average power of a horse. This is a unit which has been adopted by engineers and is known as a *horse-power*. 1 horse-power = 33,000 ft.-lb. per min. = 550 ft.-lb. per sec.

In the METRIC SYSTEM the unit for power is the WATT. This means a joule of work per sec. A joule of work is 10^7 ergs, an erg being the work done by a force of one DYNE acting through a distance of one centimeter.

Power in electrical units is converted into power in mechanical units by the relation, 746 watts = 1 horse-power.

S. R. W.

HORSE RACING. History records that the Greeks, Romans, Assyrians and Egyptians raced horses as long ago as 680 B.C. In that year horse races became part of the Olympic program and consisted of four-horse chariot races, racing with mounted horses and loose horse races. But horse racing during the last



BOYS' HORSE RACE OF ANCIENT GREECE
Segment of a krater, or vase

three centuries has been vastly different from that in vogue in the ancient eastern nations. Since the reign of Charles II in England, 1630-85, a horse race has been defined as a test of speed, endurance and courage among thoroughbred horses.

The thoroughbred is a horse bred solely for racing and with a pedigree that can be authentically traced in all of its lines to animals recorded in a recognized stud book. It is generally believed that the thoroughbred is purely of Arabian origin, but some historians have denied that assertion and said the thoroughbred possesses the blood of Turkish and Spanish horses as well as that of the Arabian. England is the cradle of the thoroughbred. It was there he was first developed. A horse called Dodsworth, bred by Charles II, is reputed to be the first race horse on record possessed of an authenticated pedigree. But the three stallions to which the modern thoroughbred invariably traces back as founders of his lineage were Byerly Turk, Godolphin Arabian and Darley Arabian, which held court in England more than 200 years ago.

Widespread Popularity of Sport. It was from England that the running horse came to America. He arrived with the first settlers in Virginia and he has been increasing by propagation and importation until now it is estimated that there are 40,000 of his breed here. The 1931 *American Stud Book* contains the names of 31,000 thoroughbreds. These include stallions, broodmares, horses in training and yearlings. Foals for 1931 were estimated at 5,000. In addition, there were several thousand bred at the various state breeding bureaus and Government remount stations which are not registered. In 1931, 8,791 horses raced on the tracks of America, Canada, Mexico and Cuba, and there were approximately 4,000 thoroughbreds in training in England. The thoroughbred horse can now be found in almost every country in the world.

In 1931 money distributed in stakes and purses by racing associations in America, Canada, Cuba and Mexico amounted to $13,674,160. In this monetary distribution the tracks in New York led with $2,508,040. Races were held on 97 tracks in America and Canada in 1930. The courses in America are in New York, Illinois, Maryland, Kentucky, Louisiana, Ohio, Florida, California, Missouri, West Virginia, Okla-

homa, Pennsylvania, Texas, Massachusetts, Montana, Nevada, Nebraska, Utah and Delaware. The most beautiful race course in the world is Belmont Park, on Long Island, 20 miles from New York City. It was opened on May 4, 1905. The course covers 650 acres with an oval track of 1½ miles, a straight course of seven furlongs and a training track of a mile circuit. The grand stand is an enormous steel structure capable of seating 18,000 persons. Some of the oldest and richest stakes in America are decided there. They include the Belmont, Futurity, Withers, Jerome and Metropolitan. The race course at Saratoga Springs, N.Y., also a beautiful course, is one of the oldest in America. Races were held there in 1863. On it rich stakes are decided every summer. The oldest race course in the world is Chester in England. Newmarket, the most famous course in England, has been in existence since 1605.

The cost of maintaining a stable of 20 race horses in America averages in the neighborhood of $75,000 a year. Those kept by the wealthy sportsmen and sportswomen cost almost twice that sum; but there are many horsemen who manage to keep 20 head in training for less than $15,000 a year. There were 1,030 thoroughbred yearlings sold at auction in America in 1931 for $2,025,135. The highest price paid was $30,000 for a colt by Sir Gallahad III and Fasnet. A like amount was paid for a filly by Sir Gallahad III from the mare Starflight. In England a yearling colt by Blanford and Florena brought $37,500 at auction. The record high price for a yearling is $75,000. New Broom, a colt by Whiskbroom II-Payment brought that sum at Saratoga Springs, N.Y., in 1928.

Horse racing as it is recognized in nearly all parts of the world is controlled by various jockey clubs or racing commissions which are in some way affiliated with the American and English Jockey clubs. The Jockey Club in America, organized in 1894, publishes the *American Stud Book*, and no horse can race at any recognized track in North America unless its name and pedigree are registered with it. The Jockey Club demands that sentences imposed by it upon those guilty of fraudulent turf practices must be upheld. It likewise respects such sentences imposed by any recognized racing association anywhere.

In England all horse races are decided on the turf. In America all the events except steeplechases (*See* STEEPLECHASING.) are run on a dirt track. In England the time of a race is not officially recognized. In America it is considered important and is made part of the official record. The five greatest races in the world are: for two-year olds, Futurity, America; for three-year olds, the Epsom Derby, England; for handicap horses, three years old and upward, Melbourne Cup, Australia; for cup horses, three years old and upward, weight for age, the Ascot Gold Cup, England; for steeplechase horses, the Grand National at Liverpool, England.

World Records. The fastest mile ever run in competition anywhere by a horse is 1 min., 34⅖ sec. C. V. Whitney's Equipoise made that record at Chicago in 1932. Whiskbroom II, also an American horse, holds the world record for a mile and a quarter. He is credited with having run 10 furlongs in 2 min. He, an English colt, ran a mile and a half in 2 min., 25 sec. at Epsom Downs, England, in 1919 and established a world record. The two-mile world record is also held by an English horse. In 1906 Pradella ran that distance in 3 min., 19⅖ sec. The fastest two and one-half miles ever recorded is 4 min., 16⅗ sec. by Golden Myrtle at Ascot Heath, England, in 1922. Man O'War holds two world records: one and three-eighths mile in 2 min., 14⅕ sec., and one and five-eighths mile in 2 min., 40⅖ sec. Both of these records he established at Belmont Park.

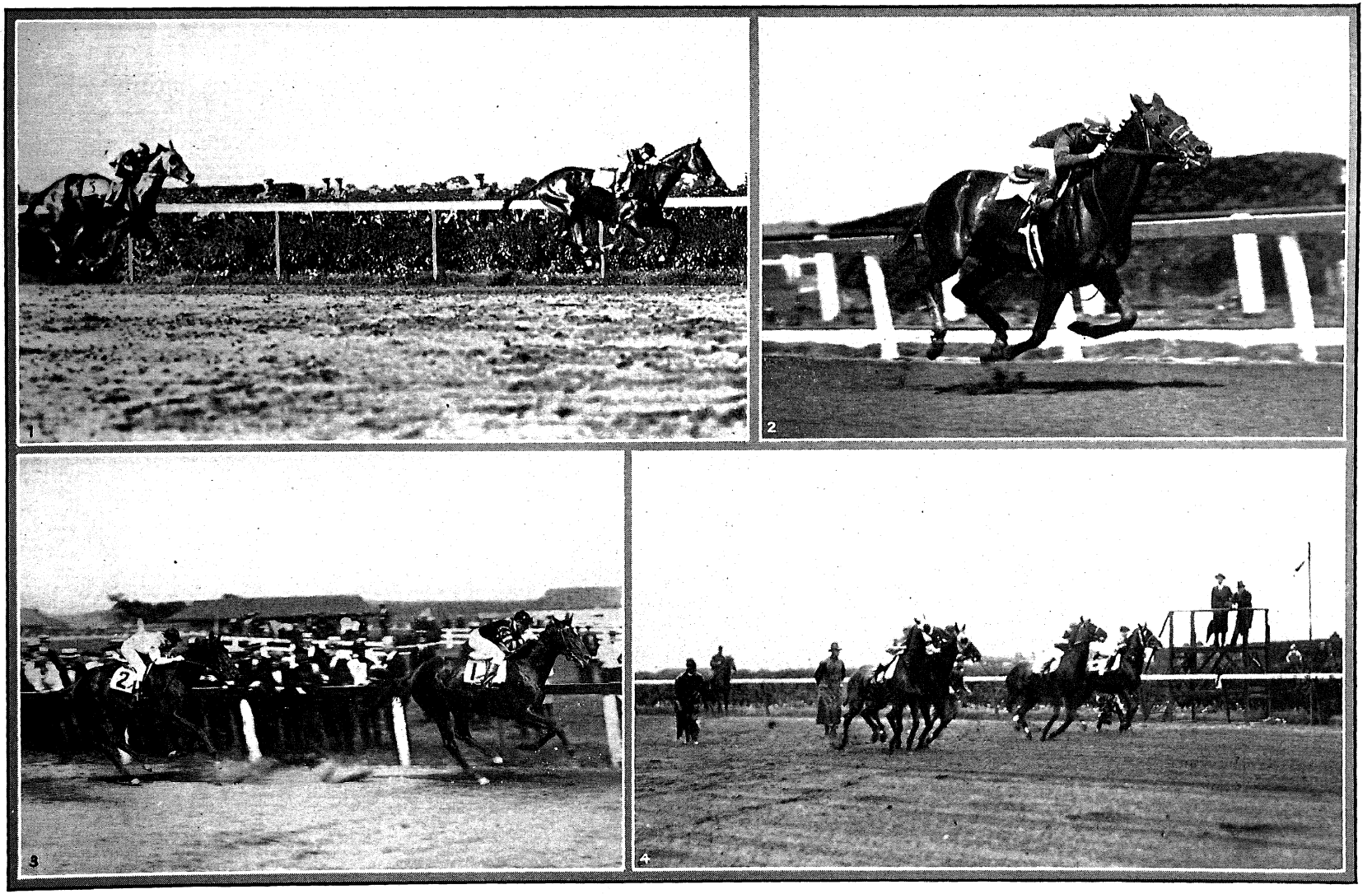
Master Willie, an English colt, ran six furlongs at Epsom Downs, England, in 1 min., 7⅕ sec. in 1901 and made a world record. Thirteen years later Iron Mask, an American horse, ran the same distance at Juarez, Mexico, in 1 min., 9⅗ sec. American racing experts consider Iron Mask's performance the better because Master Willie ran the first quarter of a mile in his race downhill. Artful, an American filly, ran six furlongs on a straight course at Morris Park in 1904 in 1 min., 8 sec. Three English horses, Kepplestone, Spionetta and Hermos, sped a mile on a straight course in 1 min., 32⅖ sec. Roamer, an American gelding, ran a mile against time at Saratoga in 1918 in 1 min., 34⅖ sec.

Famous Horses. A majority of racing experts believe Man O'War, Gallant Fox and Exterminator to be the greatest American race horses of modern times if not of all time. The three best horses in the last 50 years in England probably were St. Simon, Ormonde and Flying Fox. H. V. K.

HORSERADISH-TREE (*Moringa oleifera*), a small tree of the moringa family, native to India and planted in warm countries for ornament. It grows about 25 ft. high bearing large leaves of many leaflets, fragrant white flowers and fruit pods 1½ ft. long, containing large three-angled seeds. The root, which tastes like horseradish, is sometimes eaten, as are also the young fruits; the seeds yield ben-oil.

HORSE RAISING. The horse has had a long and interesting evolution which starts with fossil remains of almost world-wide distribution, notably in Nebraska, New Jersey, South Dakota and Wyoming. Geologists estimate its development to have required millions of years before man began to use his influence. The earliest authentic proofs of its use were found in La Mouthe Cave in France where drawings made during the Stone Age show horses of that day similar to those of to-day but varying in size and character.

According to various authorities several distinct forms of wild horses preceded the horse of history, the Celtic pony of the Hebrides and a larger, coarser animal distributed widely over Asia and Europe. To the latter belong the horses of the ancient Assyrians, Persians, Greeks, Britons and probably also of China. Another distinct type apparently became the progenitors of the beautiful Barb of Arabia, the Barbary



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FAMOUS RACE HORSES IN FAMOUS RACES

1. Finish of the 1931 Jockey Club Gold Cup Race, Belmont Park, Twenty Grand, Winner. 2. Sun Beau, one of the largest money winning horses in the world. 3. Dwyer Stakes of 1920, won by Man o' War, C. Kummer up. John P. Grier, 2nd. 4. Start of the Belmont Stakes of 1930, won by Gallant Fox (on rail). E. Sande up.

states of north Africa, and through these probably of the modern Thoroughbred.

Records on monuments in Egypt indicate that the Hyksos or Shepherd Kings of Asia introduced horses when they conquered Egypt about 1700 B.C. The animals were then used only in warfare, but somewhat later for sport, pleasure and as an emblem of luxury.

Since then the horse has ranked second to man in the civilization of the world. Among nomadic people he was used for speed. Doubtless he reached his highest all-around development among the Moors. When these people overran Spain in the 8th century they brought with them great numbers of their horses. These so raised the tone of the Spanish stock that for several centuries Spain ranked first in production of high quality horses. When the Spaniards colonized America they in turn brought their horses which are believed to be the ancestors of the mustangs of California and Mexico.

Almost coexistent with this development as a speed animal the horse began to rival the ox and the ass as a beast of burden, although he has not quite replaced either in these rôles. Since the popularization of automobiles, auto trucks and tractors, he has played less important parts than before but his service has by no means been discontinued either as a pleasure or a work animal. To be sure, the auto is now used for family driving but the horse is still bred and raised to play his four other rôles: for speed in racing; in sport for hunting; for draft and other heavy work mainly in cities, and for general work in farming. Through the centuries it is in this last capacity that he has been and is to-day of chief value to the human race yet has received the least attention as to breeding and selection. There are several well-defined types of horses: draft, coach, roadster, speed, saddle and pony, but there is no farm-horse type.

Horses used in farming are mongrels, of miscellaneous or no breed. Farmers themselves are to blame for this because they breed and rear horses to sell for other lines of business rather than to meet the needs of their farms. The result is that the best animals are sold and the poorest retained on the farm. Were a fraction of the knowledge of principles applied to farm horse breeding as has proved so revolutionary in the breeding of beef and dairy cattle, bacon hogs, mutton sheep and egg-laying strains of hens, types of horses suited to every class of farm operation would long ago have been developed.

In spite of motor development it seems probable that horses will continue to be essential to a wide range of farm work. The need, however, is for heavier animals than have been generally used in the past, so that land may be more deeply plowed than has been customary. Such animals must not be lethargic or clumsy but alert and almost graceful in action. To develop them it is necessary to start with clear conceptions of farm needs, then to breed and select so as to produce these attributes in the offspring.

Horse raising in Great Britain existed prior to the Roman conquest in 55 B.C., but the animals were the native, shaggy, hardy ponies. After the Norman conquest in 1066 stallions were imported from France, Italy and Spain mainly to meet the demands of the Crusaders for size and power rather than speed. Horses, capable of carrying loads of 350 to 425 lbs., were common among knights and cavalrymen of those days. Thus in the age of chivalry was laid the foundation of the modern draft horse.

The next epoch began with the introduction of gunpowder which being used in cannon and firearms made armor and heavy horses useless in battle. The horses, however, graduated to more constructive rôles as animate motive power for farming and hauling. For battle the demand became one for speed, so fleet Saracen horses, which had been originally brought back from the crusades, were used for breeding.

During the reign of Queen Elizabeth public horse racing appeared but it was not legal. James I legalized it, imported a pure bred Arab stallion and otherwise encouraged the breeding of light, speedy horses. All the Stuart kings set the example and encouraged horse raising by having splendid studs maintained by frequent importations of Oriental animals. Unfortunately no authentic records of breeding, other than tradition occur until the publication of the British *Stud Book*, of which the first volume appeared in 1791, marking the inception of the modern epoch. This book is the standard record of horse pedigrees.

The history of horse raising in America is linked with that of Great Britain but in colonial days it was of minor importance. During the first 200 years horses were used mainly for riding, oxen being largely employed for logging, plowing and other draft purposes. With the advent of roads horse-drawn carriages, stages and coaches were introduced and increased in popularity until railways and automobiles took their places. In spite of these improvements good horses are still in demand for farming, hunting and racing.

The statistics quoted below show which are the leading horse-producing states of the United States. There has been a striking reduction in the number of horses reared or kept in America since the introduction of mechanical motors.

HORSES ON FARMS, U.S.

5-Year Average, 1927-31

Division	*Value per Head*	*Number*	*% of Total*
UNITED STATES	$66.70	13,939,000	100.0
LEADING STATES:			
Iowa	75.20	1,055,000	7.5
Illinois	74.40	849,000	6.0
Minnesota	78.00	787,000	5.6
Nebraska	58.00	774,000	5.5
Kansas	44.00	760,000	5.4
Texas	43.20	703,000	5.0
No. Dakota	51.20	614,000	4.4
So. Dakota	51.00	596,000	4.3
Missouri	50.00	585,000	4.2
Oklahoma	36.80	509,000	3.6

In America most pure bred horses belong to one of the following principal types: Draft, which are

weighty, steady, slow-moving animals used for heavy work such as draying, include Percheron, Clydesdale, Suffolkshire and Belgian; coach, lighter, quicker moving, powerful animals used for rather heavy road work such as stage hauling, are the Cleveland Bay, Hackney, French and German Coach; roadster, rather light, rapid-moving animals developed from the American Trotter, used mainly for general driving; speed, light, very fleet trotters and pacers used for racing, such as the English Running horse or Thoroughbred and Orloff Trotter; saddle, heavier than the preceding two, more like the coach horse but lighter, quicker, more daring, alert and intelligent, therefore in demand for hunting and cavalry uses, as the Kentucky or American Saddle horse; pony, small breeds less than 52 in. high at the shoulders including Shetland, Exmoor, Mustang, Welsh and Indian.

Horses differ as widely in temperament or character as do men and are as difficult to understand. Nothing but actual experience with each individual can be used as a guide to acquaintanceship. It may be said, however, that horsemen size up the animals with fair accuracy by studying the shape of the head and the face, the character of the eyes and the action of the ears. In general, prominent eyes, wide apart, indicate intelligence; distance between the ears, character and courage; elevation and roundness between the eyes, mild disposition. Stupid horses are generally narrow between the eyes; timid ones narrow between the ears.

As the horse has a small stomach and digests his food mostly in the intestines, he needs careful and correct feeding. Most digestive troubles are due to incorrect feeding and watering. Food must be wholesome, clean, given regularly, in only moderate amounts and never too soon after hard work, though a little hay may be given sooner. Different sections of the country rely upon different feeds. In general, it would be better to feed a balanced ration made up of a greater variety than is usual in any one section. While the animal is over-heated he must not drink his fill of water for fear of foundering, though he may be allowed eight or ten swallows unless the water is very cold.

Horses are useful in proportion to their obedience. This depends first upon their training and second upon their treatment after being trained. With rare exceptions much viciousness is due to incorrect treatment either because the trainer or the driver has innocently confused the horse before he has acquired good habits and is therefore at a loss to understand what is wanted of him. Often such cases may be corrected by careful re-training. M. G. K.

HORSESHOE CRAB. *See* KING CRAB.

HORSESHOE PITCHING, a game bearing a resemblance to QUOITS, popular in the United States, notably in rural communities. Its players often attain a surprising degree of skill in the pastime, which demands a nice sense of pitch and balance, due to the uneven distribution of weight in the horseshoe. As in quoits, stakes are driven into the ground at a distance of from 18 to 24 yards, and the objectives of the game are: to pitch a ringer, that is, to throw the shoe so that it encircles the stake; to land as close as possible to the stake, or to knock an opponent's ringer or other horseshoe away from the stake. Points are variously scored. In many communities a ringer counts 3; a shoe resting against, but not encircling the stake, counts 2, and a shoe nearer the stake than the opponent's pitch, counts 1. In the United States games are often played between opposing teams, and at state fairs championship matches are a popular feature.

HORSE SHOWS, exhibitions of various breeds and types of horses, generally for purposes of sale. In the United States horse shows were first held in the late 18th century. The American horse show was designed after the model agricultural show of England. The first shows, which were informal gatherings of horse breeders in the eastern states, were held under the auspices of such groups as the New York Society for the Promotion of Useful Arts, established in 1766, and the New Jersey Society for Promoting Agriculture, 1781. After 1807, when Elkanah Watson exhibited two sheep in the town square of Pittsfield, Mass., and was accordingly credited with staging the first cattle show in this country, horse shows were frequently held in conjunction with exhibitions of cattle at country fairs. By 1900 the exhibition of horses had become so important commercially that in many localities the horse show was held independently of cattle shows and agricultural fairs. This is particularly true in the larger centers, where the general public will support the horse show in sufficient numbers to defray a large part of the costs.

Horse shows are held annually in all the chief centers of the country. Famous breeders will send their prize ponies, hunters and jumpers, saddle and light saddle horses, around the horse show circuit, after their exhibition at the chief event of the year, the meeting of the National Horse Show Association of America. Horses of light and draft breed are also exhibited, particularly in the centers of agricultural communities. In the urban communities, the annual horse show has become a social event of considerable importance. The prizes offered in the various events at these gatherings on some occasions amount to several thousand dollars. In addition the prestige of winning an award at one of the larger gatherings is an asset of considerable value to a breeder. This is indeed the chief reason for the continued popularity of the horse show from New York to California.

A unique event annually in the United States is the Military Horse show for the International Trophy, held in New York City. Since the inauguration of the event, Germany, Sweden, Hungary, France, Poland, Canada and the Irish Free State have competed with the United States Army cavalry.

HORSE-SUGAR, a name sometimes given to the SWEETLEAF (*Symplocos tinctoria*), a small tree found widely in the southern United States.

HORSETAIL, a genus (*Equisetum*) of plants of remarkable structure and aspect, called also horsetail-

rush and scouring-rush. They are allied botanically to the ferns and club-mosses but form a very distinct group, resembling the casuarinas and joint firs in external appearance and the zamias in their conelike reproductive structures. There are about 25 species widely distributed in fields and wet places in most of the world except Australia and New Zealand; about one half of the known species are found in North America. They are perennials with creeping rootstocks which send up slender, fluted, many-jointed, hollow stems. The stems usually bear numerous whorls of similarly jointed branches and minute, scalelike leaves which encircle the joints. In height horsetails range mostly from a few inches to a few feet, though the great horsetail (*E. Telemateia*) sometimes grows 10 ft. high and a South American species has stems 30 to 40 ft. long. The stems of certain species, as *E. hyemale,* which contain half their weight of silica, are used for polishing various articles, whence the name scouring-rush.

The horsetails are the only living representatives of the formerly important botanical order Equisetales, a group of plants conspicuous in the vegetation of Palaeozoic and Mesozoic times. Ancestral forms of tree-like dimensions were immensely abundant in the Carboniferous period, contributing a part of the woody material from which coal was formed. *See also* CALAMITES.

HORSEWEED (*Erigeron canadensis*), a small hairy perennial of the composite family, native to North America and very widely distributed as a weed. It grows in fields and waste grounds, usually about a foot high, with narrow leaves and numerous small heads of minute white flowers. Various other plants are sometimes called horseweed, especially the great ragweed (*Ambrosia trifida*) and the horsebalm (*Collinsonia canadensis*).

HORSLEY, SIR VICTOR (1857-1916), English physiologist and surgeon, born in Kensington, England, on April 14, 1857. He was a pioneer in experimental and neurologic surgery, particularly in his operations on the ductless glands and the brain; and in his initial operations for removal of a tumor from the spinal cord. He opposed strenuously the use of tobacco and alcohol merely on isolated observations and experiences. His famous work *Alcohol and the Human Body* (1907) was written in collaboration with Dr. Mary Sturge. M. F.

HORTA. *See* AZORES.

HORTEN, a city of Norway in the district of Vestfold, 38 mi. by water and 66 mi. by rail south of Oslo and an important point on the Oslo Fjord. There is ocean bathing. The naval base Karl-Johansvarn with fortifications, docks, radio station, flying field and a naval academy is located at Horten. Pop. 1930, 10,788.

HORTHY DE NAGYBANYA, NIKOLAUS (1868-), Hungarian admiral and regent, was born in the county of Szolrok, eastern Hungary, June 18, 1868. He attended the Fiume naval academy, and after a long period of sea service was appointed aide-de-camp to Francis Joseph. When the World War broke out he was put in command of the cruiser *Novara* and successfully raided Porto Corsini, San Giovanni di Medua, and Otranto, where he was wounded. After the downfall of the Hapsburgs, he organized the counter-revolutionary movement, and in 1920 he was elected regent of Hungary by the National Assembly.

HORTICULTURE, the art of growing flowers, fruits and vegetables, is derived from *hortus,* garden, and *colere,* to care for. Although the word gardening is similarly derived from the Anglo-Saxon *gyrdan,* to inclose, custom has limited it to narrower bounds. Horticulture, broadly speaking, embraces the application of many physical, physiological and biological laws, especially with respect to soil management, plant feeding and plant breeding.

No clearly defined line can be drawn between horticulture and agriculture, of which, like forestry and animal husbandry, it is one of the major divisions. When certain vegetables such as sweet potatoes are grown in northern gardens, they are considered as horticultural crops but in southern field culture they are agricultural. Similarly botany and horticulture are intimately related, for although the former deals with plants it relegates to the latter the cultural features of plant production. *See* LANDSCAPE GARDENING.

The importance of horticulture is indicated by the many industries that have been developed either to supply its needs or to utilize its raw materials. Among these are the manufacture of tools and implements for soil management, for spraying, dusting, pruning and grading the various products; commercial fertilizers; packages of various kinds; commercial canning, preserving and drying of fruit and vegetables; refrigerator transportation and cold storage, and the development of home and foreign markets.

Its complexities are suggested by the facts that various branches may be conducted either out of doors or under glass; that at least 25,000 species of plants are cultivated horticulturally; that some of these species have thousands of varieties; that not only each species, and in many cases each variety requires treatment somewhat different from the others; that differences of soil, climate and other conditions influence growth requirements; that market demands and foibles are as pronounced as those of individual persons; and that discoveries of new plants, improved varieties, machines, methods of cultivation, spraying, pruning, harvesting, grading and marketing are introduced annually.

Horticulture is naturally classified in six divisions: floriculture, the growing of ornamental plants as individuals; vegetable growing; pomology, or fruit growing; landscape horticulture or plant growing for its scenic effect; nursery business and the seed business.

Until the beginning of the 19th century practically all horticulture was connected with home life, but by no means with all homes capable of such development. Agriculture led with its staple field crops;

horticulture followed with its refinements and luxuries, its vegetables, fruits and flowers. Records show that the colonists brought with them seeds of garden plants as well as field crops which they tried to adapt to the alien climate with as notable failures as successes. (*See* GRAPE.) Not only were the New England and adjacent Canadian colonies leaders in such culture, but missionaries took seeds of fruits far inland as evidenced especially by the huge seedling pear trees which existed in Essex County, Ontario, until this generation. Similarly Spanish missionaries took citrous fruits to Florida and grapes, figs and olives to California.

Colonists and missionaries, however, were not the only distributors of old world plants; Indians likewise assisted, as attested by orchards of seedling peaches and other fruits which existed long before white men settled in western New York, Georgia and other sections. In exchange for such crops the Indians gave the colonists seeds of many native plants which they had cultivated for centuries. Some of these, especially corn, potatoes and grapes, have since become staples, but the number so adopted and improved is small in comparison with those that have attracted little attention.

Ornamental gardens of early colonial days to a large extent doubtless lacked landscape arrangement and were probably limited in species and varieties grown. They were thus more typically old fashioned gardens than those of to-day. One of the most notable of these was that of Peter Stuyvesant, governor of New Amsterdam (New York) in the 17th century. It was called the bouwerij, a name which still exists, although now spelled bowery. As an indication of its size, some 50 Negro slaves and several white servants were needed to keep it in order.

During the early part of the 18th century several notable plant collections existed, especially near Philadelphia where John Bartram established his famous botanical garden in 1728. Many of the trees he planted still live, for the site of the garden and the house he built are now part of the park system of the city. In the latter part of the century many wealthy people followed the example of George Washington whose formal garden at Mount Vernon, Va., typifies the formal style of the day.

According to Prof. U. P. Hedrick, there are many native plants worth cultivating as vegetables. Native beans and teparies, in the semi-arid and sub-tropical Southwest, seem likely to prove timely crops for the dry-farmers. Other promising plants are ground nuts, ground cherries, certain pigweeds and swamp potatoes. Hedrick further declares that "America is a natural orchard. More than 200 species of tree, bush, vine and small fruits were commonly used by the aborigines for food, not counting nuts, those occasionally used, and numerous varieties. In its plums, grapes, raspberries, blackberries, dewberries, cranberries and gooseberries North America has already given the world . . . 45 species . . . domesticated within approximately a half century."

Although many native American fruits have become important cultivated crops, attempts to grow the blueberry in gardens have almost always failed until the early part of the 20th century. Thousands of bushels will doubtless be gathered annually in the wilds, but the revelation of the secret of their successful cultivation will doubtless lead to increasing quantities of domesticated berries, especially when plants of improved varieties are produced in sufficient supply to meet the demands of commercial plantations. The varieties so far introduced ripen successionally and cover a season of six or eight weeks with berries several times larger and of higher quality than the usual wild ones.

The secret, discovered by Dr. F. V. Coville, botanist of the U.S. Department of Agriculture, is that the blueberry fails in all but acid soils. Neutral and alkaline soils may be made acid by the addition of such materials as commercial aluminum sulphate and spent tanbark. Because of its key nature this discovery is considered one of the most important contributions to horticulture during the present century, for it is of far wider application than merely to blueberry culture. It explains why rhododendron, mountain laurel, trailing arbutus, gentian and many other ornamental plants fail on certain types of soil, and has led to success in growing these plants after these same soils have been acidified by the application of the materials mentioned.

With few exceptions our apple varieties are descendants of two Old World species. They appeared in seedling orchards or in fence rows and other waste land, largely in New England during the half century following Revolutionary days. Similar conditions prevailed but to a less marked degree with other fruits of European descent; the foreign varieties disappeared and indigenous ones replaced them by the unpremeditated method of selecting those that met American conditions and taste. This is noticeable in the Northwest where seedlings of Russian fruits are replacing their Russian ancestors.

Until after 1800 grafting was little practiced, except upon seedling trees whose fruit was inferior, mainly because the chief use of the apple in those days was for cider and for this seedling fruit was considered satisfactory. Grafting became popular only after a market for fresh fruit began to develop. During the second and third quarters of the 19th century pomologists, especially Charles Downing, John Thomas, Patrick Barry, Marshall P. Wilder, Robert Manning and Theodatus T. Lyon, systematized fruit growing and stimulated the planting of home and farm orchards with accurately named nursery-grafted varieties of high quality. Thus they educated the popular taste of the day not only in rural but urban homes.

It is a source of great regret that many of the choicest fruit varieties are unprofitable for commercial production or are so tender they do not reach market in salable condition. In consequence poorer but more prolific kinds have replaced them except in home fruit gardens and orchards. The result is that most of the present generation of consumers have no conception of how delicious the now so-called amateur varieties

and properly ripened fruits really are. The pear especially has suffered from commercial plantings; the Kieffer variety introduced about fifty years ago, though of fine appearance, is so gritty and of such poor flavor that it has stamped pears in general as almost inedible fruits, whereas the choicest varieties are delectable.

Oranges brought to Florida by the early Spanish settlers became so widely distributed that many groves have been thought to be indigenous. Spanish missionaries also deserve credit for introducing figs, grapes, walnuts, citrous and various other Mediterranean region fruits into California in 1769. Several of these have attained great commercial importance especially since the introduction of refrigerator and rapid transportation.

The nursery business which is fundamental to horticulture is believed to have begun in New England early in the 17th century when trees and bushes were grown as crops on general farms. Not until 1730 was there an American nursery independent of other interests. This famous establishment was begun at Flushing, Long Island, by William Prince and was continued under four generations of the family for more than a century during which time it introduced countless ornamental and fruit bearing trees, shrubs and vines. The oldest nursery carried on by descendants of the founder is that of William H. Moon Company of Morrisville, Pa., established in 1767. The nursery business of to-day represents a capital of many million dollars, covers thousands of acres and employs thousands of men and women. It maintains standards in crop production by propagating and disseminating varieties "true to name and strain."

The seed business which is fundamental to field crop production, vegetable and flower growing was established in America by David Landreth at Philadelphia in 1784, and the family has carried it on continuously since then. It is the second oldest seed house of the world, its predecessor being the house of Vilmorin, Andrieux Company of Paris. Another seed house, which continued in the family for more than a century, was that established in 1802 by Grant Thorburn in New York. The development of the seed business which now includes several hundred companies, involves many million dollars and employs thousands of men and women, is parallel with that of the postal service, especially with that of rural free delivery and parcel post for although enormous quantities of seeds are shipped via freight and express, similar quantities are sent by mail.

Since the publication of Mendel's *Principles of Heredity* in 1900, plant breeding and selection have been immeasurably stimulated. The 20th century is seeing wonderful developments of new varieties, especially among vegetables and flowers which show results of hybridization usually within one or two years of starting. Among fruits progress is naturally much slower; bush fruits require three to five years and tree fruits generally longer before the first results of hybridizing or crossing can be judged. Nevertheless several improved varieties of tree fruits, particularly of apples and pears, which are slowest of all northern fruits to develop from seedlings to bearing age, have been developed by Dr. U. P. Hedrick, director of the New York Agricultural Experiment station at Geneva, and by Prof. W. T. Macoun, Dominion horticulturist of the Central Experiment Farm of Canada at Ottawa, Ontario. Other experimenters working with as definite aims as Hedrick and Macoun have produced varieties of many other fruits which promise to equal or surpass the best of their various classes.

M. G. K.

HOSE, a flexible tubing used for the conveyance of fluids flowing under pressure. They are usually made of (1) some sort of fabric—commonly linen or cotton; (2) a fabric lined with rubber; (3) solid rubber; (4) a spirally-wound metal tubing or (5) rubber or rubber and fabric tubing protected by a wrapping of wire. Important considerations involve questions of internal friction to the flow of fluids; resistance to cracking, abrasion, etc., simplicity of construction and economic considerations of cost.

The greatest application of hose is in connection with fire-fighting apparatus. For this purpose, rubber hose covered with fabric is used widely in the United States. This construction provides low friction losses of pressure together with durability and convenience of handling. Unlined fabric hose is commonly used for inside applications—as emergency fire hose, etc. It has advantages in that it deteriorates only slowly when left unused for long times; it is of light weight and can be conveniently stored in small space. Solid rubber is commonly used in small diameter sizes such as those required for garden hose. Flexible metal tubing is used in applications where resistance to abrasion is an important factor, for example in compressed air machines used in construction, etc.

Hose sizes are ordinarily specified in internal diameter dimensions. They are made in various standard lengths and usually provided with standard couplings to enable joining lengths together readily.

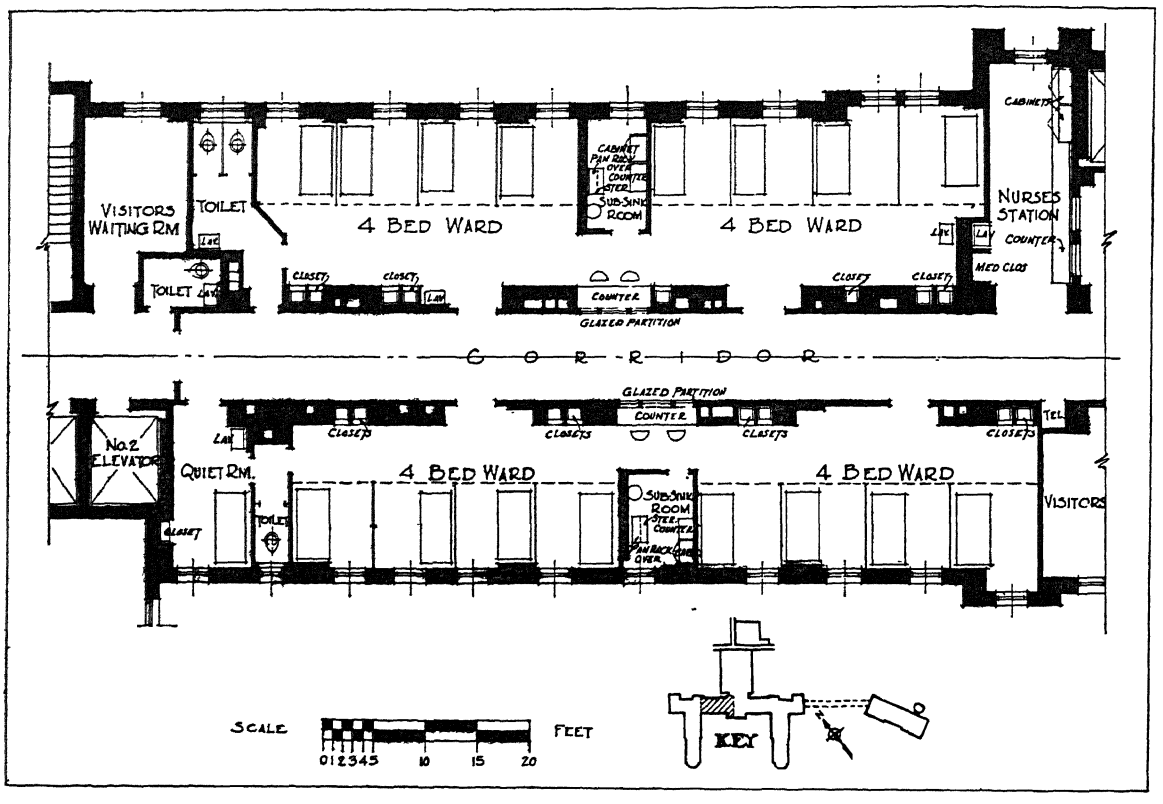
HOSEA, BOOK OF, the first of the minor prophetical books of the Old Testament, is named after a prophet of Israel living in the reign of Jeroboam II and his successors. His style, though sometimes obscure, is full of power, and his manner of presenting the relation of Israel to its God, as that of faithless wife to husband, has not only provided him with an unusual and effective symbolism, but has led scholars into various interpretations of Hosea's own life. Some believe that the relationship disclosed of a faithless wife is historic and autobiographical. Others feel that it is allegorical, and yet others compromise by seeing a substratum of reality which the prophet uses to emphasize his message. The first three chapters of the book deal with this subject, while the remainder of the book contains a series of discourses in which the sins of the people are censured. The book's place in religion has undoubtedly gained by its human analogies, and the emphasis which it places on God's goodness being the equivalent of His

love, and its ethical ideal, "I desire mercy and not sacrifice, and the knowledge of God more than burnt offerings."

HOSIERY MANUFACTURE. *See* KNITTING.

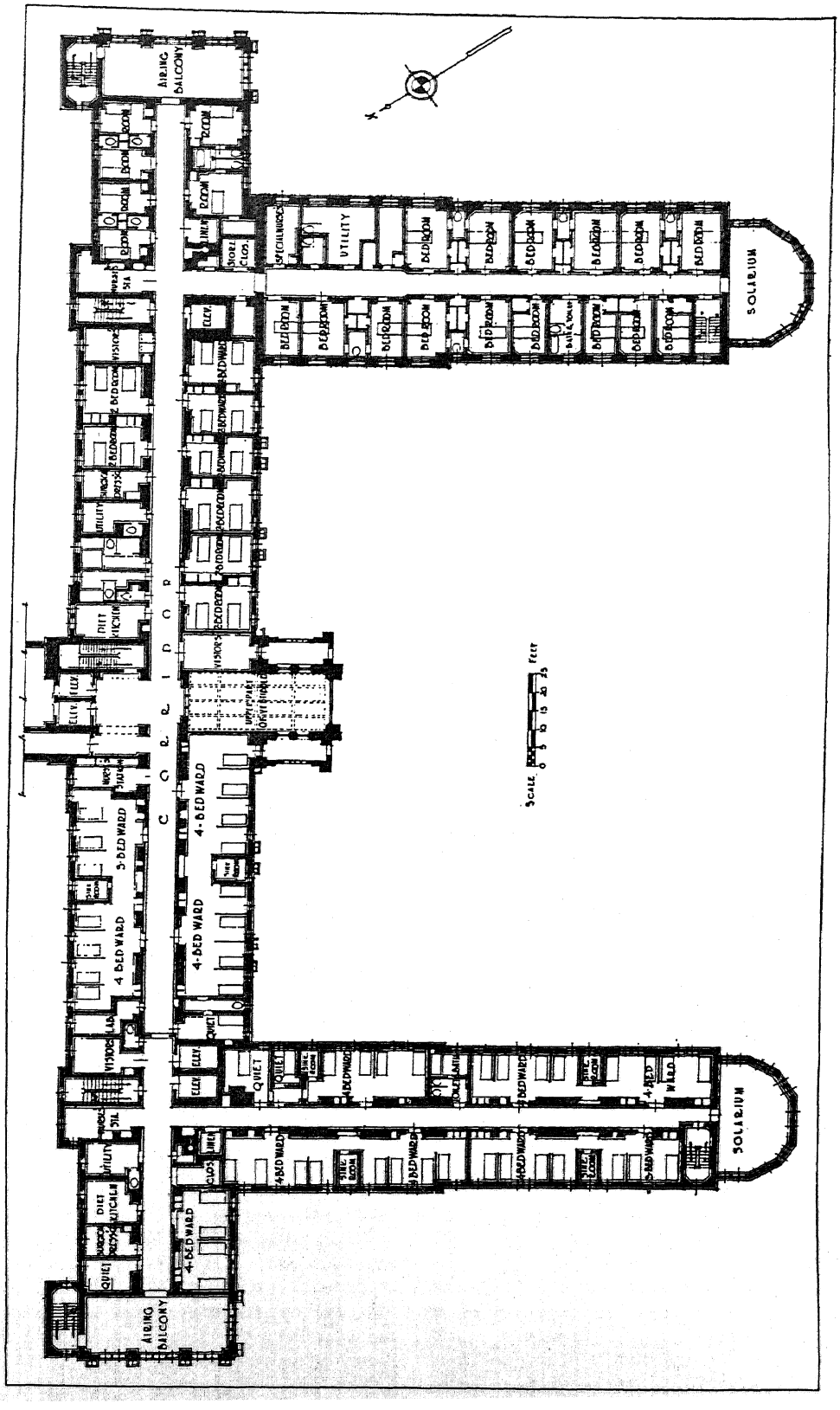
HOSPITAL ARCHITECTURE. The development of the hospital has been a long, slow process. Though the European hospital dates back to the 12th century, but little progress was made in the United States until about the beginning of the 20th century. The statistics of 1911 show the number of hospitals in the United States to be 2,500 at that time, while the latest hospital census shows 7,300; and even with this vast number, it is reported that only about 12 per cent of the sick people of this country who are ill enough to seek a doctor are cared for in hospitals. Reliable sources would indicate that during 1930 and 1931 approximately 100,000 beds were added to the hospitals of the United States, and that more than $375,000,000 was expended in that period to house these patients.

The modern hospital shows marked development over the one-story, large spread-out units of a few decades ago, some of the outstanding features being greater concentration of service, smaller and better equipped nursing units, greater facilities for the care of the patient, and a reduction of the unnecessary noises which disturb the patient. With the higher multi-story fireproof building with its quick running elevators, the service of food, supplies and personnel are greatly facilitated. There would seem to be no reasonable limit to the height of the hospital building any more than to the office building. The orientation, however, whether four stories or 20, is important, and sunlight, air and prevailing winds enter into the problem. In designing the hospital of to-day, the severe, barren, forbidding exterior of the old hospital has given way to a studied architectural treatment, pleasing to the patient and the public. The small extra cost of a well-designed exterior is more than repaid in its psychological effect on the patient and visitor. If the patient enters with a distinctly pleasant impression of the institution, this reacts favorably on the patient's convalescence. While the smaller institution still occupies its sphere of hospital activity in the United States and is functioning in hundreds of communities, the tendency for group or community hospitals, where several towns or communities join together to build a more complete plant, with better facilities, is growing.



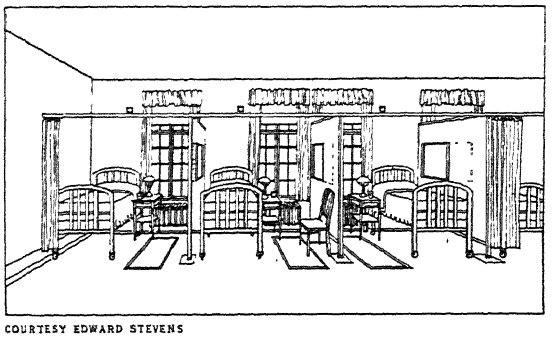
PLAN OF TYPICAL EIGHT-BED WARDS OF THE SPRINGFIELD, MASSACHUSETTS, HOSPITAL. STEVENS AND LEE, ARCHITECTS

Perhaps the most striking change in the modern hospital is the reduction in size of the wards from 10 to 30 beds to from four to eight beds. The cubicle ward, with each bed in its own cubicle, is used in many of the new hospitals. A popular size is an eight-bed ward divided into two four-bed units by placing a sub-utility room for bedpans and patients' necessities in the center. A unit of eight beds works for economy in nursing as one nurse can give service



SECOND FLOOR PLAN OF THE SPRINGFIELD, MASSACHUSETTS, HOSPITAL. STEVENS AND LEE, ARCHITECTS

to four patients through the day and eight at night. A nurse's station in the corridor or in the ward is part of this eight-bed unit. Many of the larger medical institutions in the states are recognizing and providing for patients of moderate means. This group of patients may be cared for in the better class cubicle ward, the two-bed or smaller private room. Group nursing helps to lessen the expense to the patient and



COURTESY EDWARD STEVENS

CUBICLE PARTITIONS, SHOWING INTERCOMMUNICATING SLIDES AT HEAD OF BED FOR SURVEILLANCE OF THE ENTIRE WARD

the hospital. The introduction of greater toilet facilities for the private room in the newer hospitals is noted. In some one toilet functions for two private rooms.

In the new hospitals, attempts have been made to minimize and absorb sound by the use of resilient floors, such as rubber, linoleum, cork and asphalt, and for the ceilings sound absorbing material. In many of the larger hospitals, electricity has been found not only as efficient but as cheap as any fuel for cooking and for minor heating and sterilizing, with the greater advantage of cleanliness. The radio plays a very important part in the pleasure of the patient. The patient may select his program at will by the turning of a button at the bedside table, and with the pillow transmitter the ideal equipment seems to have been reached. E. F. S.

BIBLIOGRAPHY.—E. F. Stevens, *American Hospitals of the Twentieth Century;* also files of the *American Hospital.*

HOSPITALS. The hospital perhaps had its origins in Christianity and hospitals have generally been established wherever that religion has penetrated. Other religious, however, notably Zoroastrianism and Judaism, have always taken care of their sick. The older type of hospital is a charity institution. Such institutions are supported by state or local taxation in Europe and in the United States. In the British Isles, charity hospitals are usually supported by voluntary contribution.

During the present day, however, especially in the United States, with the increase in number of a class who are able to pay for medical treatment, many pay hospitals have been established. Formerly beds were arranged in wards of about twenty-four each. Now, there is a strong tendency toward private rooms and small wards. This has resulted from modern medical standards and an increasing amount of money available to create proper accommodations. At the same time the cost of construction and maintenance has risen rapidly. The operating and obstetrical departments are quite important in the modern hospital, and frequently are the chief sources of revenue in general institutions.

A general hospital is one which treats patients with all types of diseases, though patients with highly infectious diseases are not usually admitted. Other types of hospitals are obstetrical or lying-in hospitals which take care of cases of childbirth, children's hospitals, tuberculosis hospitals, orthopedic hospitals, hospitals for incurables, and neurologic hospitals. Isolation hospitals are for the care of persons with very contagious diseases.

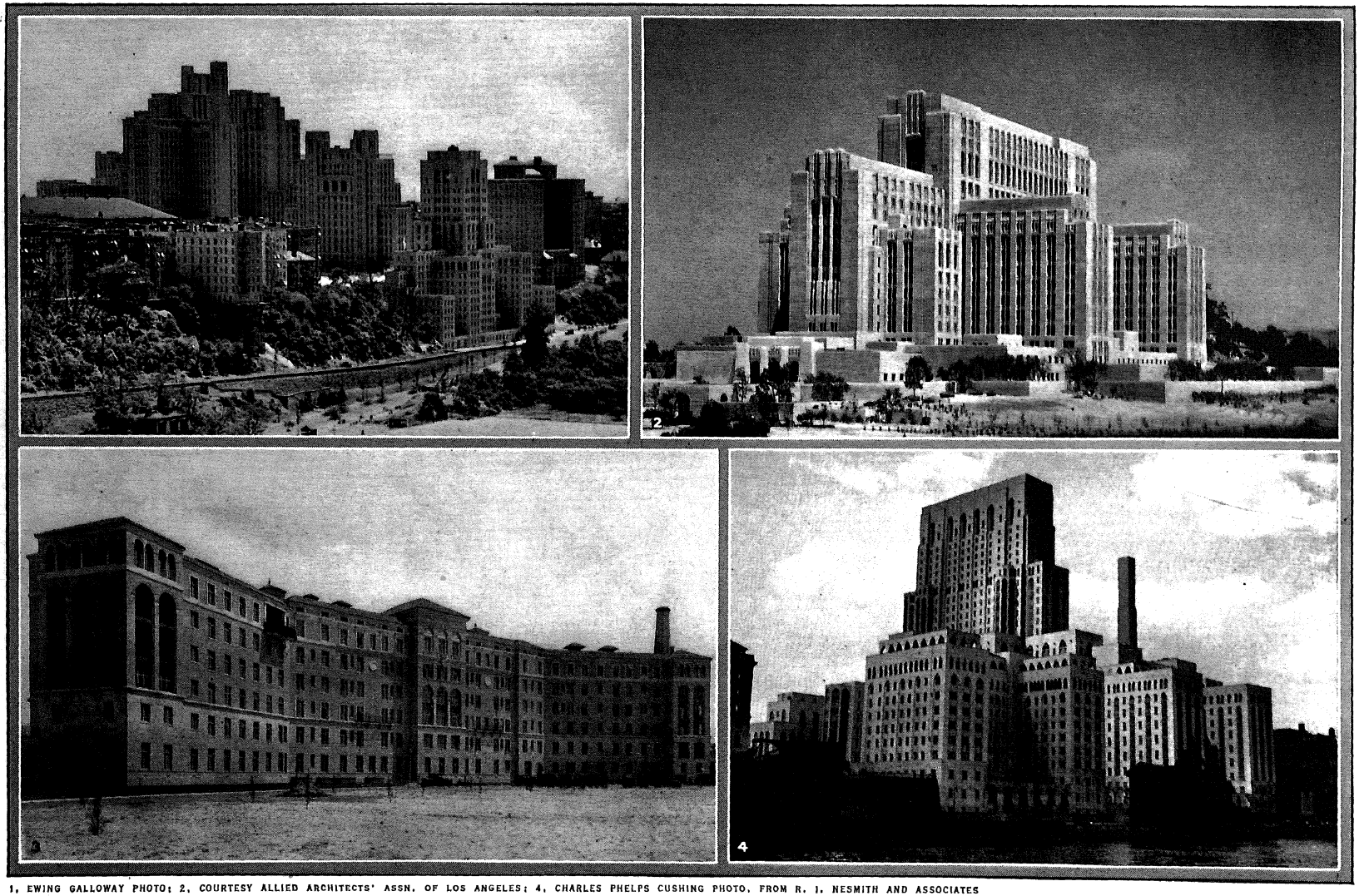
The actual number of hospitals in the United States is not increasing greatly, but the size of the institutions is increasing. In 1931 there were 6,719 hospitals in the United States, having a total of 955,869 beds and caring for 703,382 patients per year.

HOSPITALS, ARMY AND NAVY. Army hospitals may be divided into two classes stationary or fixed; field or mobile. The U.S. Army Medical Department (*see* MEDICAL SERVICE, ARMY) provides two types of fixed hospitals, station hospitals formerly called post hospitals or camp hospitals and general hospitals, including those formerly called department hospitals and base hospitals. In time of peace, station hospitals are named after the area, fort or station which they serve, e.g., Station Hospital, Carlisle Barracks, Pa. General hospitals are identified in peace time by the name of some distinguished deceased medical officer of the Army, e.g., Walter Reed General Hospital, Washington, D.C.

In time of war, fixed hospitals located in the zone of the interior are designated as in time of peace. Fixed installations located in the theater of operations are designated and identified by number, e.g., 6th Station Hospital, 4th General Hospital. The Medical Department provides the following field or mobile hospitals—Hospital stations formerly called field hospitals; surgical hospitals, formerly called mobile hospitals; evacuation hospitals; convalescent hospitals, formerly called convalescent depôts. Mobile hospitals are designated by number only, e.g., 5th Evacuation Hospital. In time of war two or more general hospitals may be grouped in an area and designated as a Hospital Center.

Fixed hospitals, i.e., station and general hospitals, are normally employed only in the communication zone and the zone of the interior; they are not used in the combat zone. Mobile or field units serve the combat zone. To meet the requirements of special evacuation problems, the Medical Department also contemplates the use of such organizations and equipment as hospital trains and hospital ships. (*See also* ARMY MEDICAL SERVICE, U.S.) H. L. G.

The Navy Department maintains 18 Naval Hospitals, 15 being within the continental limits of the United States, and three without, with locations at Annapolis, Md., Brooklyn, N.Y., Canacao, P.I.,



1, EWING GALLOWAY PHOTO; 2, COURTESY ALLIED ARCHITECTS' ASSN. OF LOS ANGELES; 4, CHARLES PHELPS CUSHING PHOTO, FROM R. I. NESMITH AND ASSOCIATES

MODERN HOSPITAL ARCHITECTURE IN THE UNITED STATES

1, Columbia Presbyterian Medical Center, New York, 1928. James Gamble Rogers, Architect. **2.** Acute Unit Building, Los Angeles County General Hospital, Allied Architects' Association of Los Angeles, Architects. **3.** Municipal Hospital, Tampa, Florida, 1927. Stevens and Lee, Architects. **4.** New York Hospital and Cornell Medical Center, 1932. Coolidge, Shepley, Bulfinch and Abbott, Architects.

Charleston, S.C., Chelsea, Mass., Great Lakes, Ill., Guam, League Island, Pa., Mare Island, Cal., Newport, R.I., Norfolk, Va., Parris Island, S.C., Pearl Harbor, T.H., Pensacola, Fla., Portsmouth, N.H., Puget Sound, Wash., San Diego, Cal. and Washington, D.C.

These hospitals are under the command of officers of the Medical Corps. Complements for naval hospitals are made up from officers and enlisted men of the Navy. The competency, from a professional standpoint, of all men in the hospital corps for enlistment, enrollment and promotion by means of examinations, is handled by the Bureau of Medicine and Surgery. The complements of the medical officers, dental officers, nurses and the hospital corpsmen for hospitals and hospital ships are recommended to the Bureau of Navigation by the Bureau of Medicine and Surgery. The management and control of naval hospitals and of the internal organization and administration of hospital ships is under the Bureau of Medicine and Surgery. Veterans Bureau patients are treated at all naval hospitals excepting Annapolis, Md., Canacao, P.I., Charleston, S.C., Guam, and Pearl Harbor, T.H.

The Navy, in addition to the 18 hospitals enumerated, operates two hospital ships with forces of the fleet, to the extent of 51,143 sick days. (*See also* NAVY MEDICAL SERVICE, U.S. R. E. C.

HOSPITAL SOCIAL WORK. Since 1895 the practice of social work in medical institutions has grown very markedly. The most accurate figures obtainable, the results of a questionnaire study conducted by a committee of the White House Conference on Child Health and Protection, indicate that slightly more than 9% of the hospitals have such departments in the United States. Training in social work is considered essential for medical social workers. In 1931 there were 11 schools in the United States giving theoretical courses and field practice in medical social work.

The primary purpose of social work in hospitals or medical institutions is to further the medical care of the patient by a method of medical social case study and treatment. Social workers in hospitals therefore perform the recognized services of social case workers. They often also participate in the administrative practices of the institution through patient management, in determining eligibility for admission, clinic management, social provisions for discharge of patients and medical follow-up. A third and important function is the responsibility of coordinating the hospital or dispensary care with the social and health planning of the community and the interpretation of the hospital and its community function to the lay groups of the community. H. B.

HOSTA, a genus of ornamental plants of the lily family formerly known as Funkia and also as Niobe. There are about 10 species, natives of China and Japan, most of which are planted in gardens. They grow in tufts or clumps composed of broad prominently ribbed root leaves and much longer flower-stalks bearing numerous white or blue blossoms. Because of the ribbed leaves these plants are often called plantain-lilies.

HOSTILE OCCUPATION, LAW OF, a law applying to territory actually occupied by a hostile army. The occupant is required to ensure order, and respect local laws and the lives and religion of the inhabitants. Taxes and contributions of money or stores, may be collected by the occupant, for administering the country or to support the occupying army. Public state, but not municipal, property may be seized; private property, except transportation and news systems, which may be taken, must be respected.

HOSTOS, EUGENIO MARIA DE (1839-1903), Porto Rican patriot, writer and educator, educated in law at the Central University of Spain, at Madrid. He advocated autonomy for Porto Rico and Cuba, and in *La Peregrinacion de Bayoan* attacked, in fictional form, the evils of the Spanish Colonial System. He later declared for secession, and went to New York to join the Cuban Revolutionary Committee. He traveled in Latin America, agitating reforms for Chinese workers in Peru, scientific education for women in Chile, and in 1875 went to Santo Domingo where he published *Las Tres Antillas,* advocating the independence and union of Porto Rico, Santo Domingo and Cuba. In 1888 he retired to Chile to work for schools, but returned to Porto Rico to demand a plebiscite, organizing for this purpose the league of patriots (1898). Feeling that his work in Porto Rico was futile, he returned to Santo Domingo, where he became inspector general of public education. He is the author of about 50 books, and of a number of poems and songs.

HÔTEL DES INVALIDES, once a great hospital for invalided soldiers in Paris, founded by Louis XIV and built 1670-75, to-day the site of a museum of artillery, a historical museum and headquarters for the military governor of Paris. It stands on the south bank of the Seine at the head of the great open Esplanade des Invalides and comprises the hotel edifice, a chapel hung with battle flags and the Dôme des Invalides, a second church containing the tomb of Napoleon I. *See* DOME. The Hôtel is an immense structure built by Libéral Bruant and J. H. Mansard and once could accommodate 7,000 men.

HOTEL MANAGER, the administrative director of a hotel's entire business. A manager is responsible for the direction of all departments of the hotel and must see that they coordinate in such a way as to keep the establishment on a profitable basis. The morale of the staff, hence the atmosphere of service and hospitality, is to a great extent as dependent on the personality of the manager as on his ability. Tact, resourcefulness and executive powers are necessary to insure the efficiency of the employees and the satisfaction of the guests. Many large hotels are now successfully operated by women.

HOT SPRINGS. Boiling, simmering, or merely hot springs are characteristic phenomena of certain regions of former volcanic activity, like Yellowstone

National Park, Wyoming. Their high temperature is ascribed to the contact of ground water with hot rock masses and vapors in the depths below. Warm springs occurring apart from any direct indication of volcanic disturbance, are believed to come from great depths, and to derive their heat from chemical or mechanical changes in the rocks.

The high solvent power of the often gaseous waters of hot-springs brings to the surface large quantities of lime carbonate, silica, or other mineral matter, which colors the pools deep blue or green. Their margins are encrusted with a whitish or tinted material called sinter, which forms basins and terraces of great beauty.

Thousands of hot-springs are found in the Yellowstone region. The most spectacular are of the spouting type, called GEYSERS. Boiling springs which evaporate too rapidly to overflow become thick with mineral matter and are called "paint-pots" or if spasmodically eruptive, "mud-geysers." The single mammoth hot-spring known as Excelsior Cauldron, discharges 4,400 gallons of water a minute.

The medicinal properties of certain hot springs have been known from Roman times. Round such springs as those at Bath, England, Carlsbad, Austria, and Aix-les-Bains, France, towns and cities have grown up. Among the more famous American curative thermal springs are those at San Bernardino, California, Sweet Springs, Virginia, and Hot Springs, Arkansas, where 46 medicinal springs are included in Hot Springs National Park. *See also* MINERAL WATERS.

HOT SPRINGS, a city and the county seat of Garland Co. in southwestern Arkansas, situated 57 mi. southwest of Little Rock. The city is one of the world's most famous watering resorts. Hot Springs is located between two ridges of the Ozark Mountains. There are 46 therapeutic springs in and around the city. "Bath House Row" is a unique street whose institutions are under government auspices. The curative powers of the springs, which were discovered by the French about 1800, were known to the Indians and also to De Soto. Lewis and Clark visited here. The United States government made a permanent settlement at Hot Springs in 1832, creating a reservation. The United States maintains an army and navy hospital on the reservation. Bus lines, air lines and two railroads serve the city. In 1929 the manufactures reached an approximate total of $1,000,000; the retail trade amounted to $12,993,564. There is a transient population of 300,000 every year. The Hot Springs National Park of 1½ sq. mi., famous for its scenic beauty, is near the city. Near by are lakes Catherine and Hamilton formed in the building of a large hydroelectric power project. Pop. 1920, 11,695; 1930, 20,238.

HOT SPRINGS, a city in southwestern South Dakota, the county seat of Fall River Co., situated 65 mi. south of Rapid City. It is served by two railroads. The city is famous as a health resort because of its hot medicinal springs. It has large hotels and sanitariums, and is the seat of the State Soldiers' Home and the Battle Mountain Sanitarium, built by the government. The city is a trade center for an agricultural and mining region. Pop. 1920, 1,697; 1930, 2,908.

HOT SPRINGS NATIONAL PARK, a tract of 1½ sq. mi. containing 46 medicinal hot springs, is located in the Ouachita Mountains of central Arkansas. The region was given park status in 1921, though in one sense it is the oldest national park in the country, having been created a special reservation in 1832. These hot springs were probably visited in 1541 by Hernandez De Soto.

Government analysis shows more than 20 chemical constituents in the waters, and it is these or their combination which prove effective in the treatment of certain diseases. The waters from the different springs vary in temperature from 102° to 147° F. They flow at the rate of 851,308 gals. per day and are under government control.

Hot Springs is about 57 mi. west by south from Little Rock. It is accessible via the Chicago, Rock Island and Pacific; Missouri Pacific; Illinois Central and other railroads. Good roads lead to it from practically all points in the United States, and it is on the direct line of the Bankhead Highway reaching from Washington, D.C., to San Diego, Calif.

HOTTENTOT, a South African language comprising several dialects, of which Nama is the best known. It has been considered Hamitic (*see* HAMITO-SEMITIC) because it distinguishes sex-gender in the singular; and its use of three numbers, singular, dual and plural, is a remarkable phenomenon in African. It employs "clicks," though only four as contrasted with the eight of BUSHMAN.

BIBLIOGRAPHY.—C. Meinhof, *Die Nama-Sprache,* 1909.

HOTTENTOT-FIG (*Mesembryanthemum edule*), a succulent perennial of the carpet-weed family native to hot, arid regions in South Africa and widely naturalized through cultivation in mild climates. The woody prostrate stems bear very thick, three-sided, opposite leaves, large, yellow, solitary flowers and a fleshy edible fruit. The plant which is used for ground-cover and as a sand-dune binder has become well established in California; in southern England it thrives on sea-cliffs, forming long pendant masses.

HOTTENTOTS, a semi-nomadic people formerly inhabiting practically the entire western portion of South Africa from the Kunene River south to the Cape Peninsula and inland from the Atlantic to the Kei River. In racial characteristics and language they are so closely related to the BUSHMEN that they are believed to be the result of a mixture of Bushmen with early invading Hamites. They have also mixed with the Bantus. With the Bushmen they form a race sometimes known as Khoisan. In stature they are taller than the Bushmen, averaging about 63 inches. Their skin is yellow or yellow brown, and their faces have very high cheek bones, flat noses and bulging foreheads. Cattle-breeding is the pivot of Hottentot existence and the sole measure of a man's wealth. The Hottentots formerly had great

herds of long-horned cattle and flocks of fat-tailed sheep. In recent years they have taken up agriculture on a small scale. The number of wives a man had was limited only by his ability to pay for them in cattle. Hottentot religion is founded on the worship of hero-gods. Tribal organization is now found only in southwest Africa north of the Orange River. The Hottentots are a dying people who have mixed extensively with Europeans and East Indian slaves and now form the basis of "Cape colored," "Griqua" and "Rehoboth" half-breeds.

HOUDON, JEAN ANTOINE (1741-1828), French sculptor, was born at Versailles, Mar. 18, 1741. He executed a series of busts in terra cotta and marble, which by their truth and intelligence, lifted him above his contemporaries. His sitters included Diderot, Gluck, d'Alembert, Buffon, Mirabeau and Molière. His masterpieces are the seated Voltaire, in the Théâtre Français, and the busts of the Brongiard children and of his own small daughters in which he has admirably rendered the tenderness of youthful flesh. Houdon came to America and executed a statue and head of Washington. He was made a member of the Legion of Honor by Napoleon, in appreciation of his bust of the Emperor, the Empress and Marshal Ney. He died at Paris, July 16, 1828.

HOUGH, EMERSON (1857-1923), American author, was born in Newton, Iowa, June 28, 1857. He graduated in 1880 at Iowa State University and for the next 15 years roamed through the West. In the winter of 1895 he explored Yellowstone Park on skiis. Of his 22 books, the first was *The Singing Mouse Stories,* published in 1895; later favorites were *54-40 or Fight, The Mississippi Bubble,* and *The Covered Wagon* which was featured in motion pictures. Hough died at Evanston, Ill., Apr. 30, 1923.

HOUGHTON, ALANSON BIGELOW (1863-), American diplomat, was born at Cambridge, Mass., Oct. 10, 1863. He studied at the universities of Harvard, Göttingen, Berlin and Paris. In 1889 he became associated with the Corning (N.Y.) Glass Works, of which he was president in 1910-18 and thereafter chairman of the board of directors. He was elected to Congress in 1918 and reelected in 1920. On the resumption of diplomatic relations with the Central Powers in 1922, President Harding appointed him ambassador to Germany, a post for which he was well fitted by his understanding of Germany's post war problems. He remained in Germany until 1925, when he was transferred to England to succeed Frank B. Kellogg. He played an important part in the negotiations leading to the signing of the Briand-Kellogg Peace Pact in 1928. He resigned his ambassadorship in March, 1929.

HOUGHTON, a lake port town in northwestern Michigan, the county seat of Houghton Co. It is situated on Lake Portage, opposite Hancock and served by lake steamers in season and by three railroads. The principal manufactures are copper and copper wire, whose raw material comes from the copper mines in the vicinity. Houghton is favorably known as a summer resort; timber-cutting and farming are among the leading interests of the region. It is the seat of Michigan College of Mining and Technology. Founded by Douglas Houghton, the town was incorporated in 1867. Pop. 1920, 4,466; 1930, 3,757.

HOULTON, a town in northeastern Maine, the county seat of Aroostook Co. It is a port of entry, situated on the Canadian border, 115 mi. northeast of Bangor and is served by the Bangor and Aroostook and the Canadian Pacific railroads. The town's chief crop is potatoes. The local manufactures include lumber products, starch and fertilizers. Houlton is the seat of Ricker Classical Institute and has a junior college. Pop. 1920, 6,191; 1930, 6,865.

HOUMA, a city in southeastern Louisiana, the capital of Terrebonne Parish, situated on the Bayou Terrebonne and the Intra-Coastal Canal. The Southern Pacific Railroad and bus lines serve the city. Oil is found in this region and the chief crops are sugar cane, corn and truck products. There are lumber mills, vegetable and shrimp canneries and larger sugar refineries. Houma is a notable muskrat fur market. It was founded in 1834, incorporated in 1845, and became a city in 1898. Pop. 1920, 5,160; 1930, 6,531.

HOUND. Dogs of houndlike characteristics are delineated on monuments of the Assyrians and other ancient peoples, and because of their hunting proclivities were probably the first dogs to companion man. All hounds are game-hunters; they are classified by the American Kennel Club as "sporting dogs, hounds," as opposed to such sporting bird dogs as spaniels and retrievers, and include 16 varieties. The jackal-hunting Afghan, and the ancient Saluki, or gazelle hound, are perhaps the purest breeds of dogs extant. Bassets, the slowest of hunting dogs, beagles, harriers, American and English foxhounds are used for hare, rabbits, foxes and occasionally larger animals. Bloodhounds were formerly put to deer and fox, and dachshunds to badger. Otterhounds, naturally, take well to water. Scottish deerhounds, favorites of Landseer and Burns, Russian wolfhounds and Irish wolfhounds, the tallest dogs known, follow large game, as do Norwegian elkhounds, which also herd reindeer and pull loads. The swift greyhounds and whippets are run after artificial hares. G. E. F.

HOUR CIRCLE, any imaginary circle in the heavens drawn through the celestial poles and at right angles to the equator.

HOURI, from the Arabic *haura,* the women of Paradise, mentioned in the Koran (*sura* 55) as "damsels with retiring glances," whom "neither man nor *jinn* hath ever touched." They will attend the heroic faithful after death and give them non-inebriating drink. They are a major element in the sensuous heaven promised by the Prophet to all who fell in the path of Allah, i.e., holy war.

HOURS, CANONICAL (Latin *horae canonicae*), in the Catholic Church the hours of the day appointed for the prayers of the clergy and monks. The ancient Church observed the prayer hours cus-

tomary in the synagogue (Acts 2:15; 3:1; 10:9), but changed them to nine, twelve and three o'clock. In the 4th century the midnight (when Paul and Silas sang in prison) prayer was added and also services at dawn and twilight and at bedtime. These hours were made obligatory for the monasteries, cathedral and collegiate chapters and the prayers were provided in the BREVIARY. The eight hours, which have been established since the 6th century, are: matins, lauds, prime, terce, sext, none, vespers and compline.

HOURS OF LABOR. *See* LABOR, HOURS; LABOR UNIONS.

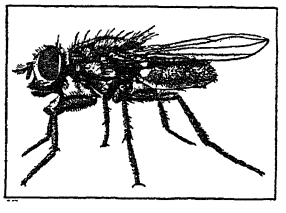
HOUSATONIC RIVER, a river of Massachusetts and Connecticut, rising in the Berkshire Hills in northwestern Massachusetts. It flows southward into Connecticut and empties into Long Island Sound about 4 mi. east of Bridgeport. This river has a length of 123 mi., and a fall of 983 ft., which gives it abundant water power for numerous manufactures. The area drained, estimated at 1,933 sq. mi., is hilly, wooded country along the upper reaches and in the lower basin is an open and level district. The cities of Dalton and Pittsfield, Mass., and Canaan and New Milford, Conn., are located on its course. Its chief tributary is the Nantucket River which joins it at Derby.

HOUSE, EDWARD MANDELL (1858-), American statesman and diplomat, was born at Houston, Tex., July 26, 1858. He specialized in politics and economics at Cornell University in 1878-79 and entered politics at once. House concluded that for him the preferable work lay behind the public scenes, and throughout his career he never accepted a public office. He soon gained wide influence in the Democratic Party in Texas where he lived as a planter. In 1912, at the Democratic Convention, he succeeded in having Woodrow Wilson nominated as the Party's presidential candidate. On Wilson's election he became the President's trusted personal adviser.

In Jan. 1915, House was sent to Europe in an attempt to mediate between the Powers at war, but failed to find any basis of peace. In December of the same year he was sent upon a second attempt, this time seeking to have the Allies announce their peace terms with the understanding from Wilson that if these were satisfactory, the United States would enter the war if Germany refused them. The Allies refused, however, to state their terms. With the entry of the United States into the war House was appointed to the Supreme War Council as chairman of the American Commission, and in that capacity signed the Armistice on behalf of the United States. He had influenced Wilson in drafting the Fourteen Points and at the request of the President he drew up a tentative draft of the Covenant of the League of Nations. He was a member of the American delegation at the Peace Conference. When the Senate refused to ratify the Versailles Treaty without amendments, House advised the President to submit to this inevitable alteration of his treaty. Wilson refused, and this disagreement led to a decisive break between the two men. He is the author of *The Intimate Papers* and (with Charles Seymour) of *What Really Happened at Paris.*

HOUSEBOAT, a pleasure craft which is a combined house and boat. The earliest mention of a houseboat occurs in Chinese records. It was a recreational residence of the Roman emperors, and was built on a palatial scale. The modern vessel, built for a small family or other group, and easily towed from one mooring or anchorage to another, will often contain several sleeping-rooms, a library, cook's galley and a promenade deck. A few navigate under their own power. Houseboats are exceedingly popular on the Thames, and English families often spend an entire summer in these floating homes. They are also widely used in the United States, notably in Florida waters, and on the Hudson and St. Lawrence rivers.

HOUSE FLY, a well-known two-winged fly (*Musca domestica*) of the family *Muscidæ,* probably the most common of all household insects. The eggs are laid preferably in horse-manure, or on decaying vegetable matter or in other forms of manure, if this is not available. Here the larvæ feed, becoming mature in about a week. The pupa stage last another week. Adult flies are ready to oviposit two weeks after they emerge. Thus during a warm season, a generation a month may be produced. Adult flies are known to be carriers of typhoid fever, dysentery and other intestinal diseases of man. Screens, the use of sticky fly-paper, swatting, trapping and poisoning help to control adults. Prevention of breeding is the most important control measure. To effect this keep garbage cans tightly closed, store manure in tight receptacles, or treat it with borax immediately after removing it from the barn. J. R. T.



COMMON HOUSE FLY

HOUSE FRAMING. *See* WOOD CONSTRUCTION.

HOUSEHOLD APPLIANCES. After the application of electric power to household uses other than lighting, came the development of a large group of appliances, which not only simplify, by mechanising the duties of housekeeping, but make many of them automatic in operation. These devices owe their creation and their present highly developed use to three things: 1. The application of electricity to domestic heating equipment purposes; 2. The improved application of gas for both domestic heating and cooking; and 3. The use of oil and gas in domestic heating.

These devices have not been created as a group, but have been developed one after the other, and gradually refined to their present state of reliability. Both cooking and water heating by gas were familiar when electricity was first applied in the simple form of the flat iron, toaster and grill, coffee and water heaters and electric fan, and motor applications to sewing machines, polishers, ice cream freezers and the like.

Electricity began its service in the home as power, with the introduction of the electric vacuum cleaner and the electric washing machine. (*See* LAUNDRY EQUIPMENT.) The electric washer was first marketed in 1907, and the early VACUUM CLEANERS about the same time. Neither appliance made great progress in distribution and use until the years following the World War. Between 1907 and 1919, however, both machines went through great development and refinement in design and construction. The post-war years, because of definite demand, the increase in average net income, and the shortage in domestic help, found these products ready to supply the rapidly expanding market. It was in these years, too, that mechanical household refrigeration (*see* REFRIGERATION, MECHANICAL HOUSEHOLD) began to be actively studied and developed.

Another addition of electric power in the home, getting its start during the same period as electric refrigeration, was the application of the electric motor to the problem of HEATING OF BUILDINGS, both with oil and with coal. The electric motor-driven oil burner has exhibited a growing use, because of refinements of design and reliability of operation. For coal burning furnaces, the mechanical stoker, in which the electric motor operates a fan for forced draft and also a device for placing coal on the fire and removing ashes from the furnace, is a still later development. As with mechanical automatic refrigeration, these house-heating devices may be automatic in operation, thermostats regulating the room temperatures by turning on and off the heating system. In the domestic refrigerator thermostats maintain a predetermined temperature.

Automatic operation has also been applied to the electric range, where timing devices operated by a clock permit the housewife to place a fully prepared meal in the range, set the temperature at which the meal is to be cooked, and set the clock. So, without her presence the clock will start the cooking operation, carry it through the desired period, and then turn off the heat.

Electric and gas water heater systems have been made completely automatic. With one type, opening the tap starts the heating source; with another, especially the electric water-heater system, water is stored in an insulated tank at a high temperature. A thermostat, turning off and on the heat, according to the temperature of the water in the tank, is the controlling device.

Still another application of electric power is the automatically controlled pumping of water, employed chiefly in rural and suburban homes. Pumps drawing from wells, store water under pressure within the house, the pumping starts automatically when the pressure in the tanks is reduced by drawing of water. The mechanical development of these devices has kept pace with changes in the standard of living. More recently, electrically operated RADIOS and clocks have become common.

The degree to which the mechanization of the home has progressed is indicated by the following figures: There are 20,000,000 homes in the United States in which electricity is used in at least one way. The electric flat iron is the most widely used of all domestic electrical appliances, approximately 98% of all families having electrical service using this appliance; 44.4% of such families own electric vacuum cleaners; 35% own electric washing machines; 12.8% own electric refrigerators. Approximately 14,000,000 families in the United States use gas for cooking, and 1,000,000 cook with electricity. L. E. M.

HOUSEHOLD REFRIGERATION. *See* REFRIGERATION, MECHANICAL.

HOUSELEEK (*Sempervivum tectorum*), a fleshy perennial of the orpine family called also hen and chickens. It is a native of Europe and Asia, widely planted for edgings and in rock gardens, and runs wild in various parts of the United States. The stout stem gives rise to a dense basal rosette of 50 or more wedge-shaped leaves and an erect hairy flower stalk, about a foot high, which bears a panicle of large, pinkish-red flowers.

HOUSE OF COMMONS. *See* PARLIAMENT.

HOUSE OF LORDS. *See* PARLIAMENT.

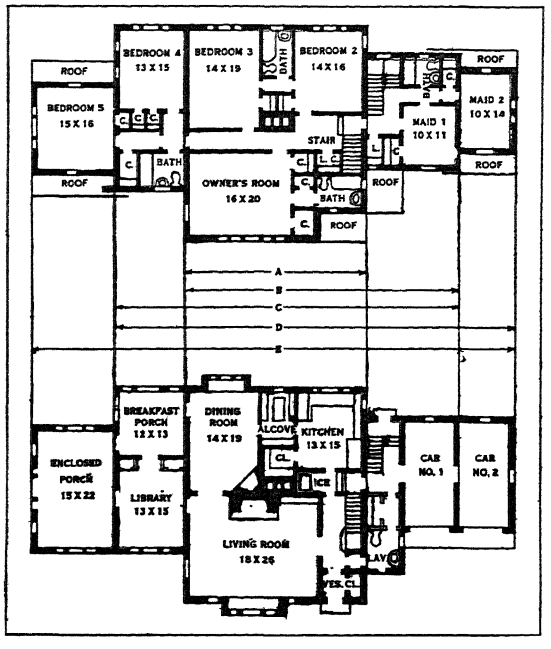
HOUSE OF REPRESENTATIVES. See REPRESENTATIVES, HOUSE OF.

HOUSE OF SEVEN GABLES, THE, a novel by NATHANIEL HAWTHORNE; published 1851. It is concerned chiefly with the working out of a hereditary curse. This story of four cousins is set in Salem, and is supposed to be told by a lodger in the House of Seven Gables, the last stronghold of that decayed family, the Pyncheons. The interest centers around the efforts of Judge Pyncheon, a scheming politician, to have his cousin Clifford committed to an asylum —efforts which terrify his other cousins, Hepzibah and Phoebe, but which come to naught when the old man is struck down in the nick of time by a fit of apoplexy.

HOUSE PLANNING. The primary considerations in house planning, affected rather by the site than the personal predilections of the owner, are those of orientation, exposure and approach. The proper disposition of rooms is so intimately tied up with the path of sunlight, the view, and the prevailing winds, that it is impossible to formulate any intelligent plan without an understanding of the relation of its component parts to the site itself. A model house with kitchen, garage, maids' rooms and stairs facing the north, leaving a south and west exposure for the principal rooms as well as the best view, might be a model of what to avoid if built on another site where the compass points were reversed. With these three exigencies in mind, the house plan must be made to conform to the nature of the land. Study must be given to the contours, whether the site is on rock, earth, sand, or clay, and note must be made of valuable trees to be spared by the excavators. A plan made for a level, cleared plot devoid of rock, while appearing ideal in a magazine, may be the worst solution of a problem if forced upon a rocky hillside

against the unspoken protests of Nature. Consequently three more impersonal factors, contours, rock excavation and trees, must be considered before the owner's individual requirements.

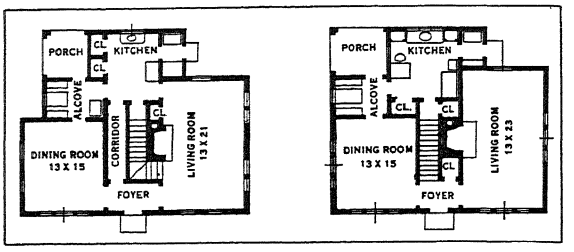
Economic Factors. The next points in order of importance are essentially economic, and paramount among these is the adequacy of the contemplated investment to cover the cost of what is desired. This is so obvious a problem in everyday life, so fundamental to every purchase, that it is surprising how little it is understood in its relation to home building. Neither architect nor builder may be at fault if bids come in high after an owner has asked for eight rooms for the price of six; but it may seem harder to fix responsibility in cases where the client's requirements in materials and equipment result in a house of six rooms costing the price of eight. The planning of a house means much more than its design upon paper; it should entail the economic correlation of architecture and industry, of labor and materials, of cubic content and equipment, and, equally important, of initial cost and upkeep. Two further economic factors are important. Is the house to conform sufficiently to average demand to permit of easy resale, or shall it be planned uniquely for its present owner? If the latter, shall it be designed for the later additions or shall it be entirely complete as built? Whatever decision is made the result must in some measure be a compromise. Sacrifices may be required to enhance resale value; sacrifices of immediate beauty or utility may be required to bring about the final harmony or efficiency of a later development, or extra expenditures may seem advisable to avoid still greater expense in the future.



A HOUSE PLANNED FOR FUTURE EXPANSION. GERALD L. KAUFMAN, ARCHITECT

A, first step, six rooms; B, second step, adding garage and maid's room; C, third step, adding library, porch and fourth bedroom; D, fourth step, adding second garage and second maid's room; E, final house with five master's rooms, two maids' rooms and two garages

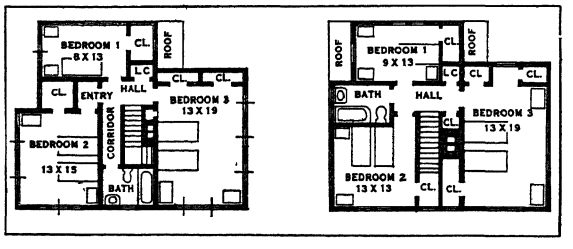
Personal Preferences. Having so far studied the problem impersonally, it is now possible for an architect to prepare the program of requirements of the owner. The intimacies of an owner's family life, his hobbies, his present and future plans, and his bank account are all to have a bearing upon his house plan, and the owner must discuss these with his architect.



A POOR FIRST FLOOR PLAN (LEFT), RE-ARRANGED INTO A GOOD FIRST FLOOR PLAN (RIGHT)
Gerald L. Kaufman, Architect

Careful study should be given to room locations and room sites, and should also be given, though generally it is not, to room functions and the time use of each unit. Is the upstairs stairhall alcove to become a dressing-room, sewing-room, smoking-room, or study; or shall it be enlarged, on paper, into a spare room or an extra bath? Any one of these, once decided upon, may force the rearrangement of many important elements in the plan, and may in consequence change the entire design.

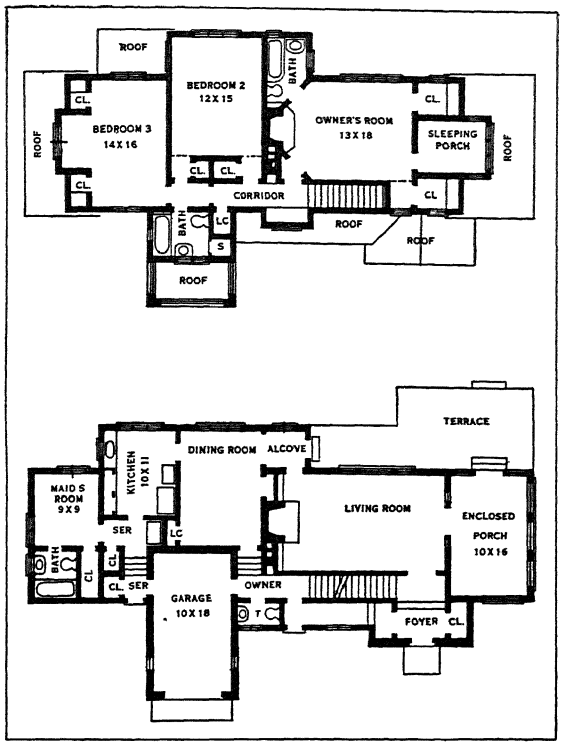
Given the number of rooms and their approximate sizes and usage, and knowing the requirements of the property and the owner, it is possible to particularize further. Definite choice may now be made between the center-hall type and the side-hall type of plan; the former separating living-room from dining-room, the latter locating them adjacent to one another. Decision may likewise be made as to the bungalow-type, story-and-a-half, or the usual two-story house; as well as to whether there shall be wings, servant's quarters with separate stairs, or maids' rooms in a third story or attic. The garage location can be decided upon, whether this shall be a separate unit, semidetached, enclosed in the house itself, or built under part of the first floor. The number of baths may determine



A POOR SECOND FLOOR PLAN (LEFT), RE-ARRANGED INTO A GOOD SECOND FLOOR PLAN (RIGHT)
Gerald L. Kaufman, Architect

whether these are to serve one room only, to be arranged for use by two-room suites, or placed off a hall for use by several rooms. Questions such as these cannot be answered empirically; their solution differs in each case; the factors involved are individualistic, not general. The model home does not exist, until fitted to the model property and the model owner.

The choice of materials and equipment are likewise a part of the house plan. A specification calling for the latest mechanical devices and electric appliances, and the best of materials and workmanship, may add more to the cost of a home than the addition of one or two



PLAN OF A HOUSE IN WHICH EVERY ROOM HAS EXPOSURE AND VIEW. GERALD L. KAUFMAN, ARCHITECT

extra rooms. Furthermore, a sophisticated exterior with complicated roofing, profuse ornament and elaborate architectural detail, may increase the cost considerably more than additional floor area and higher ceilings. There must consequently be a reconciliation between materials, equipment and exterior design before a final balance can be struck between plan requirements and contract cost. In a house plan the size, number and disposition of rooms may depend upon the quality of materials and mechanical equipment, and the style of architecture chosen for the exterior.

The choice of a style is more than a mere question of knowing what one likes. Economic questions may easily confound a didactic decision. A log-cabin built hundreds of miles from a forest is an extreme example; but a dream house of stone for a wooded water-front site may equally well produce a rude awakening when the bids come in. In house planning one must curb a taste for stone walls, English manors, Norman or Tudor half-timber, and French or Italian Renaissance, if the budget indicates the expediency of a preference for the clapboard or shingled exterior of Dutch or New England Colonial. A comparison of the styles themselves is unnecessary here; but a study of house planning does not permit their being ignored. The early American style still remains the most appealing and attractive to modern American pocketbooks.

As economic life becomes more and more mechanized, the home becomes increasingly a mechanical and machine-manufactured unit, with manual labor cost constantly decreasing as material and equipment cost rises. Instead of building a fireplace in each room, affecting the plan as well as the cost of labor at the job, we now buy and install built-in radiators. Instead of excavating for a huge coal bin, we buy and install an oil burner, and this in the future may be eliminated in favor of the gas fueled boiler, which in turn may give way to the electric radiator and the cellarless house of our descendants. As the cellar grows smaller with the coming of modern equipment, so, too, does the attic. The huge open space under the rafters formerly used for storage now gives way to the insulated third floor with an extra bedroom and bath or a playroom; or it is abandoned entirely, and the two-story house becomes two stories in fact, with no space wasted.

Specifications and Contracts. Once a house plan is definitely determined and sketched out on paper, together with elevations of the four façades, the next step is to translate this plan into the language of the builder by means of working drawings and specifications. It is obviously impossible to build a house, with any accurate idea of its final cost or ultimate appearance, from the rough sketches and simple block plans shown in magazine illustration or mail-order catalogues. Working drawings must show the exact dimensioned position of every wall, window and partition, and specifications must tell every material to be used and how and where it is to be applied. Materials must be specified for the sole reason that each is the best and most economical for the use to which it is to be put, a requirement in specification writing which can be met only by the disinterested agency of an architect. The entire purpose of plans and specifications, followed up by a contract and reliable superintendence, is to avoid misunderstandings and disputes during building, with their corollaries, disappointments and extra costs. Working drawings and specifications together give a complete description of a house. The value of these technical descriptions is seen when the bids come in from competing contractors, showing very often a difference of over 25% between the highest estimate and the lowest.

The final steps, after the contract has been signed, are those of actual building. During this stage there should be constant superintendence by an architect, to see that the work is being properly executed. The

architect's work is by no means completed when he has finished the plans; the small-scale working drawings must be further clarified by means of large scale details; the owner must be assured, by the issuance of certificates for payment to the builder, that he may safely meet the latter's requisitions on account of work actually accomplished; and the innumerable questions and problems which arise during construction, must be solved in justice to all concerned, so that the work may progress smoothly and in perfect coordination. House planning is not finished until the house itself is finished; the serviceability of rooms depends upon their being properly constructed; and planning in the three dimensions of actuality is as important as preconceiving the plan in the two dimensions of paper drawings.

Last of all, after a final inspection by the architect, comes the final certificate, completion. The house plan now achieves its purpose. The model-house has become a reality for its plot, its environment, its use, and its owner; and the elements have been combined at last, into the harmonious unit to be called henceforth, instead, a home. G. L. K.

HOUSE SPARROW, a sparrow (*Passer domesticus*), native in Europe and the Near East. It has attached itself to human habitations from time immemorial, is the sparrow of the Bible, and wherever European civilization has extended itself, has accompanied the colonists. It was brought to the United States first in 1850, spread rapidly, and came to be called "English" sparrow, an unfortunate misnomer. It now thrives in all parts of the continent, clings to towns and in places has become a rural pest. It frequently is a nuisance by its noisy, belligerent ways, and by making its slovenly nests in undesirable places. To its credit, however, is its diligent destruction of insects in the spring. Recent studies have shown that it is really not a sparrow but belongs to the family of weaver-birds (*Ploceidæ*).

HOUSING. Less than 1% of the United States population live in slums, but a great many families dwell under conditions that are improvable. Many of the most unsanitary conditions are due to ignorance or poverty. This is true in rural districts as well as in cities for there are still millions of families living in shacks of one, two or three rooms which are unprovided with modern sanitation and household conveniences.

The first and most obvious means of meeting the housing problem is through health, building and housing laws. Important legislation in the United States has been based upon a Model Housing Law prepared and published by Lawrence Veiller, Secretary of the National Housing Association. This law with slight modifications is in operation in several states such as Michigan, Minnesota and Iowa.

The second essential is a well-endowed department for housing records and inspection and approval of plans under expert direction. The third essential is a private housing association made up of leading citizens who are interested in speeding the solution of the housing problem. Such associations in Philadelphia, Pittsburgh and Cincinnati, for example, have performed invaluable service in reporting illegal conditions, in informing the local public as to the nature of the housing problem and in making improvements.

The fourth essential is a local Better Homes in America Committee cooperating with the national organization in Washington. The 8,000 local Better Homes Committees are concerned with an educational program as distinguished from the legislative programs of the housing associations. They operate through lecture and discussion programs and contests for home improvement in which all householders may join. They also arrange for demonstrations of the better types of inexpensive homes which can be made available to families of modest means.

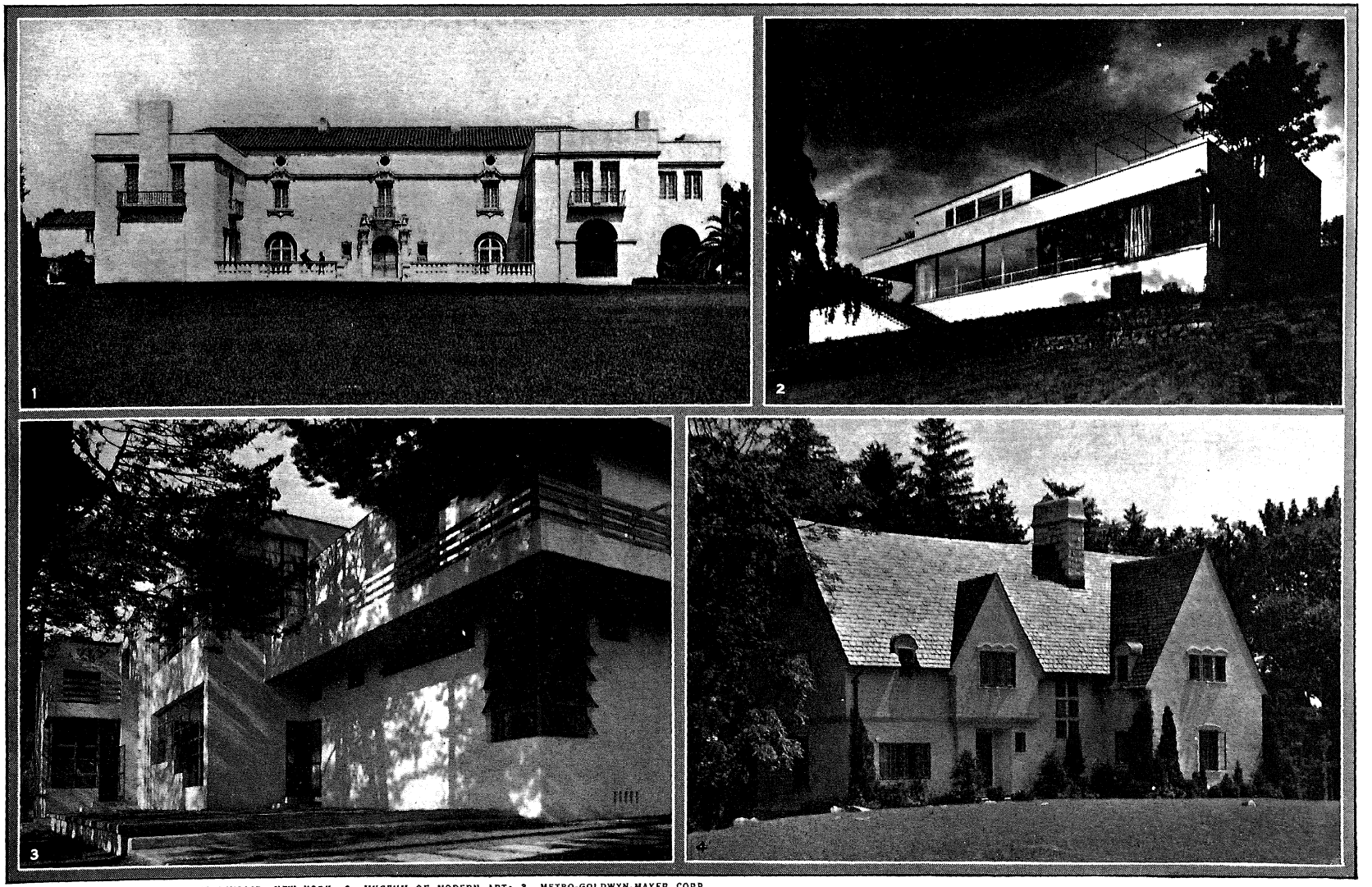
Other important ways of meeting the housing problem are through city planning and zoning laws and through the building of model apartments and communities. These are organized on the limited dividend basis, dividends of the invested capital being confined usually to 5% but sometimes 6%. The model tenements of suburban developments in some cities are notable for their skilful planning for recreation and for the protection of children from traffic through the provision of protected walks and underpasses. J. F.

BIBLIOGRAPHY.—Further information on Housing can be obtained from Division of Building and Housing, U.S. Dept. of Commerce, Washington, D.C.; National Housing Association, New York; Better Homes in America, Washington, D.C.

HOUSMAN, ALFRED EDWARD (1859-), English writer and scholar, was born Mar. 26, 1859. He was educated at Oxford, and in 1892 became professor of Latin at University College, London. After 1911 he held the same post at Cambridge University. *A Shropshire Lad,* 1896, won him recognition as a poet. *Last Poems,* published in 1922, increased his reputation. Housman has edited Juvenal and other classic authors, and contributed many articles to periodicals. His writings are distinguished for scholarship and for a somewhat caustic wit.

HOUSMAN, LAURENCE (1865-), English author and artist, was born July 18, 1865. He studied art and made a reputation as an illustrator for the famous writers of his day before, in 1896, he turned to literature with the publication of *Green Arras,* a book of verse, and *All Fellows,* an allegorical tale. His first play, *Bethlehem,* was produced in London in 1902. Among his other works are *Mendicant Rhymes,* 1906, *An English Woman's Love Letters,* 1900, *Prunella,* a play written in collaboration with Granville Barker and produced in 1904, *Angels and Ministers,* 1910, *Little Plays of St. Francis,* 1922, *Ironical Tales,* 1926, and *Palace Plays,* 1930.

HOUSTON, DAVID FRANKLIN (1866-), American educator and cabinet officer, was born in Monroe, N.C., Feb. 17, 1866. He was graduated from South Carolina College in 1887 and from Harvard in 1892. He served at the University of Texas



1, COURTESY MAYERS, MURRAY AND PHILLIP, NEW YORK; 2, MUSEUM OF MODERN ART; 3, METRO-GOLDWYN-MAYER CORP.

MODERN TRENDS IN HOME ARCHITECTURE

1. Coppell House, Santa Barbara, California. Bertram G. Goodhue, Architect. 2. Tugendhat House, Brno, Czechoslovakia, 1930. Mies Van Der Rohe, Architect. 3. Home of Cedric Gibbons, Santa Monica Canyon, Santa Monica, California, designed by the owner. 4. R. K. Stritzinger residence, Scarsdale, N. Y. Julius Gregory, Architect.

as a professor of political science from 1894 to 1902 and as president in 1905-08. From 1908 to 1916 he was chancellor of Washington University at St. Louis. President Wilson appointed him Secretary of Agriculture in 1913, an office he held until 1920. From Feb. 1920 to Mar. 1921 he was Secretary of the Treasury as well as chairman of the Federal Reserve and Farm Loan Boards. Later he became president of the Mutual Life Insurance Co., N.Y. He has published *A Critical Study of Nullification in South Carolina,* and *Eight Years with Wilson's Cabinet.*

HOUSTON, SAM (1793-1863), American soldier and statesman, born near Lexington, Va., Mar. 2, 1793. He left home as a youth, and lived with the Indians until 1813, when he enlisted in the United States Army. In 1817 he became an Indian agent among the Cherokees. He took up the study of law, and was elected district attorney of Nashville, Tenn., in 1819. He was elected to Congress in 1823 and 1825, and two years later made Governor of Tennessee. In 1832 Houston went to Texas, becoming commander-in-chief of the Texan army. He defeated Santa Anna at the battle of San Jacinto, Apr. 21, 1836, thus liberating Texas from Mexican rule. Texas declared its independence, and Houston was elected president of the new republic in 1836. He opened negotiations with the United States Government for the annexation of Texas, which occurred in 1845. Houston served in the United States Senate from 1846 to 1859, when he was elected Governor of Texas. At the outbreak of the Civil War, he pronounced his loyalty to the Union, and the Confederacy forced him from office in 1861. He died at Huntsville, Texas, July 26, 1863.

HOUSTON, a port city in southeastern Texas, the county seat of Harris Co. It is situated on the Houston Ship Channel, the old Buffalo Bayou, 50 mi. from the Gulf of Mexico and 241 mi. southeast of Dallas. Bus and truck lines, an interurban railway to Galveston and four trunk line railroads serve the city. There are two commercial airports. Houston owes its prosperity to its excellent harbor, extensive wharves and harbor belt railroad, all owned by the city. The United States Government and the county shared the expense of deepening and widening the channel and improving the facilities of the port, which have cost, up to 1928, about $20,000,000. Houston is now a port for vessels going to all parts of the world. The traffic of the harbor for 1930 was valued at $506,898,443. The chief exports are petroleum, cotton products, grain and rice. Houston has large oil refineries, cotton and cottonseed oil mills, oil field equipment shops and railroad shops. In 1929 the industrial output was worth about $144,000,000; the wholesale trade proper amounted to $219,341,484; the retail, to $185,471,473.

Houston is the seat of Rice Institute, a university founded by William Marsh Rice in 1891, and heavily endowed; the beautiful buildings cover 300 acres of campus. The student body exceeds 2,000; there is no tuition fee. Houston was founded in 1836 and named for Gen. Sam Houston, the hero of the Battle of San Jacinto, which gave Texas her independence on Apr. 21, 1836. The battleground, now a state park, is 22 mi. south. Houston was incorporated in 1838. Pop. 1920, 138,276; 1930, 292,352.

HOVENWEEP, a national monument, comprising four remarkable groups of prehistoric towers, pueblos and cliff dwellings in Hackberry and Kelly canyons, southwestern Colorado and in Ruin and Cajon canyons across the state line in Utah. The monument is 285.80 acres in extent and was established Mar. 2, 1923. Towers, generally two or three stories high and containing from one to several rooms, are a distinctive feature of these ruins. The towers are rectangular, circular, semicircular, oval, or D-shaped and their use, whether as forts, castles, granaries or religious edifices, is not known. The Hovenweep monument is easily accessible by automobile. It is about 50 mi. west of MESA VERDE NATIONAL PARK and but a mile off the main travelled road between Dolores, Colo., on the Denver and Rio Grande Western Railroad, and Bluff, Utah.

HOVEY, RICHARD (1864-1900), American poet, was born at Normal, Ill., May 4, 1864. He graduated from Dartmouth College, studied theology for one year and then went to Europe. A Bohemian existence followed; he was successively actor, playwright and poet. Later he lectured on English literature at Barnard College, New York. With BLISS CARMAN he published the charming *Songs from Vagabondia.* Other works are *Launcelot and Guinevere* and *Along the Trail.* The poet has won thousands of admirers by his idealism, his romantic subject matter and his lilting, graceful verse. Hovey died at New York City, Feb. 24, 1900.

HOWARD, BRONSON (1842-1908), American playwright, was born in Detroit, Mich., Oct. 7, 1842. He was with the New York *Tribune, Evening Mail* and several other New York papers from 1867-72. In 1864 his *Fantine* was produced in Detroit. *Saratoga* was produced by Augustine Daly in 1870. Other successes followed, including *The Banker's Daughter,* 1878; *Young Mrs. Winthrop,* 1882; *The Henrietta* and *Met by Chance,* 1887; *Shenandoah,* 1889; *Aristocracy,* 1892, considered by some his best play, and *Peter Stuyvesant,* written with Brander Matthews, 1899. Howard died Aug. 4, 1908.

HOWARD, HENRY, EARL OF SURREY. *See* SURREY, HENRY HOWARD, EARL OF.

HOWARD, JOHN GALEN (1864-), American architect, was born at Chelmsford, Mass., May 8, 1864. Educated for his profession at the Massachusetts Institute of Technology and the Ecole des Beaux-Arts, Paris, he studied also under various architects and then established his own practice in New York City. He was awarded a gold medal for his design for the Electric Tower of the Pan-American Exposition, Buffalo, 1901, and in the same year was appointed supervising architect and professor of architecture at the University of California. He designed numerous buildings for that university, as well as

many public and private edifices in New York and other cities. He was director of the university's school of architecture, 1913-27.

HOWARD, LELAND OSSIAN (1857-), American entomologist, was born at Rockford, Ill., June 11, 1857. Upon his graduation from Cornell University in 1877 he was made assistant in entomology, U.S. Department of Agriculture, and later became chief of the Bureau of Entomology. In 1927 he was appointed principal entomologist of the Department. He is the author of *The House Fly, Mosquitoes, The Insect Book* and other works on insect life.

HOWARD, OLIVER OTIS (1830-1909), American soldier and educator, was born at Leeds, Me., Nov. 8, 1830. After graduation from Bowdoin College and West Point, he fought in important engagements during the Civil War, including the battles of Antietam, Chancelorsville, Chattanooga, Gettysburg and Fair Oaks, where he lost an arm. He was an officer with Sherman on the March to the Sea. In 1864 Howard was commissioned brigadier-general. He was head of the Freedmen's Bureau, 1865-74; commander in Indian fighting, 1874-81; Superintendent of West Point, 1881-82; and Commander of the Army of the East from 1888 until his retirement in 1894. He was largely responsible for the government's establishment of Howard University for Negroes, named in his honor, in 1867, and was its president, 1869-72. In 1895 he founded Lincoln Memorial University, Cumberland Gap, Tenn., for mountain whites. Howard died at Burlington, Vt., Oct. 26, 1909.

HOWARD, SIDNEY COE (1891-), American dramatist, was born at Oakland, Cal., June 26, 1891. After studying with Professor Baker at Harvard, 1915-16, he served in France and the Balkans, later working on the New York publication, *Life*. Howard's plays include *Swords, S.S. Tenacity, Casanova, Sancho Panza, Bewitched,* with Edward Sheldon, *They Knew What They Wanted,* Pulitzer Prize Play, 1924, *The Silver Cord, Lucky Sam McCarver,* and *Salvation,* with Charles MacArthur.

HOWARD COLLEGE, a coeducational institution at Birmingham, Ala., controlled by the State Convention of Alabama Baptists. It was chartered in 1841 and named in honor of John Howard, English reformer. Opened at Marion, Ala., in 1842, the college was moved to Birmingham in 1887. In 1931 the productive funds were $735,674. The library contained 21,000 volumes. The student enrollment in 1931-32 was 550; the faculty of 37 was headed by Pres. John C. Dawson.

HOWARD UNIVERSITY, at Washington, D.C., a coeducational institution attended chiefly by Negroes, was chartered by Congress in 1867. It had its beginning in a missionary meeting in 1866 at the First Congregational Church of Washington. The institution was named for Gen. Oliver Otis Howard, who was active in its promotion and gained for it the aid of Freedman's Bureau. The university comprises schools of Religion, Law, Medicine, Dentistry and Pharmacy, departments of Architecture, Chemistry, Engineering, Education, Commerce and Finance. In 1879 Congress appropriated $10,000 toward current expenses, and since then the appropriation has been increased. The endowment in 1930-31 amounted to $843,546. The library of 54,000 volumes contains a special collection of Negro Americana. In 1930-31 there were 2,737 students and a faculty of 248, headed by Pres. Mordecai W. Johnson.

HOWE, ARTHUR (1890-), American educator, was born in South Orange, N.J., Mar. 3, 1890. He graduated from Yale in 1912; and from Union Theological Seminary in 1916. Howe taught at Loomis Institute, Windsor, Conn.; at the Taft School, Watertown, Conn.; and from 1928-30, was a professor at Dartmouth. In the latter year he became president of Hampton Normal and Agricultural Institute.

HOWE, EDGAR WATSON (1853-), American writer and editor, was born in Treaty, Ind., May 3, 1853. At 12 he began work in a printing office, and at 19 was publisher of the *Golden Globe,* Golden, Colo. In 1877 he became owner and editor of the Atchison, Kan., *Daily Globe,* and continued as such until 1911, when he established *Ed Howe's Monthly.* His books are mostly based on rural life and include *The Story of a Country Town, Plain People* and *Ventures in Common Sense.*

HOWE, ELIAS (1819-67), American inventor of the sewing-machine, was born at Spencer, Mass., July 9, 1819. He worked with his father, a miller, until 1836, when he learned the trade of machinist. For nine years he experimented with a sewing-machine, and patented his first model in 1846. In 1847 Howe went to England, where he sold the British rights in his invention for $1,250. He returned to the United States in 1849, and engaged in a costly series of infringement suits. In 1854 his rights were recognized by the patent courts. After the Civil War he established a sewing-machine factory at Bridgeport, Conn. His invention revolutionized the clothing industry and he was awarded many medals, including the cross of the Legion of Honor. He died at Brooklyn, N.Y., Oct. 3, 1867.

HOWE, JOSEPH (1804-73), Canadian statesman, was born at Halifax, N.S., Dec. 13, 1804. As editor of the *Nova Scotian* after 1828 and a member of the Nova Scotia parliament after 1836 he consistently advocated responsible government for Nova Scotia until such was conceded in 1848. He was premier of Nova Scotia in 1860-63. Howe also advocated union of the British American provinces, but was opposed to the movement of the '60's out of which union came, and visited London in 1867 attempting to persuade the British government to repeal Confederation. He ended his opposition, however, on a promise of better terms to Nova Scotia, and entered the Dominion cabinet in 1869. But he was never altogether at ease in this capacity and resigned in 1873 to become lieutenant governor of his native province. He died on June 1, 1873. An arresting orator in spite of the deficiencies in his education and a skilled politician Howe enjoyed great popularity in Nova Scotia.

HOWE, JULIA WARD (1819-1910), American author and reformer, was born at New York City, May 27, 1819. In 1843 she married Samuel G. Howe, and helped him conduct *The Commonwealth,* of Boston, an anti-slavery paper. In 1861, while visiting the camps near Washington, she wrote *The Battle Hymn of the Republic,* which made her famous. She worked earnestly for various reforms, and wrote several books, including two volumes of poems and her *Life of Margaret Fuller.* She died at Oak Glen, R.I., Oct. 17, 1910.

HOWE, RICHARD, EARL (1726-99), English admiral, was born in London, Mar. 8, 1726, and went to sea at the age of 14. Thereafter he took part in many naval conflicts and in 1776 was assigned command of the English fleet on the American coast, where in 1778 he defended his position against the stronger forces of D'Estaing. In 1783 he was made first lord of the admiralty, and in 1788 received an earldom. In 1794 as commander of the Channel fleet, he won a brilliant victory at Ushant. Howe died Aug. 5, 1799.

HOWE, SAMUEL GRIDLEY (1801-76), American physician and philanthropist, was born at Boston, Mass., Nov. 10, 1801. He graduated from Brown University in 1821, and in 1824 from Harvard Medical School. The next six years he served with the Greek Army, organizing its medical staff and later aiding in forming a colony at Corinth. In 1831 he studied the methods used in Paris in educating the blind and then returned to Boston to open schools for the blind and train teachers for similar schools. (*See* BRIDGMAN, LAURA.) Howe was primarily responsible for the establishment of the Massachusetts School for Feeble Minded Children and originated the Massachusetts State Board of Charities and Corrections. With his wife, JULIA WARD HOWE, he founded the *Daily Commonwealth* in 1851. He died at Boston, Mass., Jan. 19, 1876.

See "Samuel Gridley Howe 1801-76," Social Service Review, Vol. 1., 1927; J. T. Faris, *Men Who Conquered,* 1922.

HOWE, SIR WILLIAM (1729-1814), English general, was born Aug. 10, 1729, and educated at Eton. When he was 21 he became a captain in the army and in 1758 was sent to America in command of a corps of infantry, serving with Wolfe at Quebec. In 1775 he went to Boston with reinforcements for General Gage whom he succeeded that same year as commander of the British troops in America, with the rank of general. He took part in the battles of Bunker Hill, Long Island, White Plains and Brandywine, but was recalled in 1778. Howe died at Plymouth, July 12, 1814.

HOWELL, FELICIE WALDO (1897-), American painter, was born in Honolulu, Sept. 8, 1897. She studied at the Corcoran Art School, Washington, D.C. In 1922 she became an associate member of the National Academy. Howell's paintings include *A New England Street,* in the Corcoran Gallery, Washington; *The Return of the 27th Division,* National Gallery, Washington; *The Avenue of the Allies,* American Legion Building, Gloucester, Mass.; *The Flower Woman,* Telfair Academy, Savannah; and *The Pierce-Nichols House, Salem,* Metropolitan Museum, New York.

HOWELLS, WILLIAM DEAN (1837-1920), American author, was born at Martin's Ferry, O., Mar. 1, 1837, the son of a printer and newspaper man. He had little formal education. At an early age he learned typesetting and printing, working at his trade on several Ohio newspapers, and at 22 he was made news editor of the *State Journal* at Columbus, O. He became an excellent reporter and also produced some verse at this time. From 1861-65 Howells was the American Consul in Venice. He returned to the United States and served as editor of the *Atlantic Monthly* from 1872-81, in which capacity he gave encouragement to many of his contemporaries, including HENRY JAMES; later he wrote for *Harper's Magazine.* Howells's first novel, *Their Wedding Journey,* 1872, immediately commanded attention as a realistic study of common American types. It was followed by a notable succession of realistic studies of American life. Perhaps the outstanding of all these is THE RISE OF SILAS LAPHAM, published in 1885, others of note being *A Modern Instance,* 1882, *A Hazard of New Fortunes,* 1889, and *The Quality of Mercy,* 1892. Among his other works are *Literary Friends and Acquaintance,* 1901, *Literature and Life,* 1902, *My Mark Twain,* 1910, *Years of My Youth,* 1916, and books of verse, travel and literary criticism. Howells was insistently American in his choice of subject; he was an excellent craftsman and during his lifetime was considered the outstanding realistic novelist of America. He died in New York City, May 11, 1920. *See also* AMERICAN LITERATURE.

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HOWISON, GEORGE HELMES (1834-1916), American philosopher, was born in Montgomery Co., Md., Nov. 29, 1834. He was graduated from Marietta College in 1852 and Lane Theological Seminary in 1855. He joined the faculty of the University of California in 1884, where he remained until 1904. As Mills Professor of Philosophy he became known as an effective teacher. He was founder of the Philosophical Union of the University of California. His philosophy may be characterized as personal idealism and is best expressed in *The Limits of Evolution,* 1901. He died Dec. 31, 1916.

HOWITZER, a short cannon for curved fire, for hitting objects behind obstacles, such as troops in trenches. Between howitzers and guns of the same weight, howitzers are shorter, of larger caliber, fire bigger shells but at lower velocities, and usually have shorter ranges.

HOWKAN, one of the few inhabited towns of the HAIDA, a tribe of North American Indians. It is on Long Island off the Alaskan Coast.

HRADEC KRÁLOVÉ (German *Königgrätz*), an old city in Czechoslovakia at the confluence of the

Labe and the Orlice rivers. It has a Gothic cathedral of the 14th century, an episcopal residence, and a library. The new industrial district of the city is built on the other bank of the Labe. The principal products of the factories are chemicals, tanned hides, matched wood, tallow products and candy. Hradec Králové has an interesting medieval history, but is especially noted for the Battle of Königgratz, July 3, 1866, between the Prussians and the Austrians which brought about the hegemony of the former in Germany. Pop. 1929, about 19,000.

HRDLICKA, ALES (1869-), American anthropologist, was born at Humpolec, Bohemia, Mar. 29, 1869. After a high school education he came to the United States and studied at the Eclectic College and the New York Homeopathic College. From 1894 to 1899 he was employed by the New York State Service in the study of the insane. In 1903 he was appointed assistant curator of the division of physical anthropology of the United States National Museum, becoming curator in 1910. He published works upon the relationship between ethnological characteristics and insanity and upon the physical anthropology of many parts of the earth.

H. SOPHIE NEWCOMB COLLEGE FOR WOMEN, the women's department of TULANE UNIVERSITY OF LOUISIANA, at New Orleans, was founded in 1886 upon the donation of $100,000 from Mrs. Josephine Louise Newcomb. During her lifetime Mrs. Newcomb made other gifts of money to the college, and on her death left it a bequest of $2,700,000. The student enrollment in Newcomb College in 1931 was 663.

HSUAN TUNG. *See* PU YI, HENRY.

HUANG HO. *See* HWANG HO.

HUARAZ, a town of Peru, capital of the department of Ancachs, situated on the river of the same name about 180 mi. northwest of Lima. Its port is Casma. Huaraz is an Indian town surrounded by snow-capped mountains, rich in undeveloped deposits of gold and silver. Est. pop., 1927, 25,000.

HUBBARD, ELBERT (1859-1915), American writer, was born at Bloomington, Ill., June 19, 1859. In 1891, while traveling in England, he visited William Morris's Kelmscott Press, and on his return to America founded his own Roycroft Press at East Aurora, N.Y. Here books were bound by hand, and other handicraft industries carried on. The Roycrofters in 1894 began publication with *A Little Journey to the Home of George Eliot,* the first of a monthly series, and with *The Philistine,* a monthly magazine which was continued until 1915; from 1908 to 1917 they also published *The Fra.* Most important among Hubbard's works are *The Message to Garcia,* 1899, *Time and Change,* 1899, and *The Man of Sorrows,* 1906, *Elbert Hubbard's Scrap-Book,* 1923, and *The Note Books of Elbert Hubbard,* 1927. The writer was drowned in the *Lusitania* disaster, May 9, 1915.

HUBER, FRANZ (FRANCOIS) (1750-1831), Swiss naturalist, was born at Geneva, July 2, 1750. He had scarcely begun his studies when he became blind. By the aid, however, of his servant Franz Burnens and later his wife and son he continued his investigations all his life. In 1792 he published his *Nouvelles Observations sur les abeilles* which contained the first thorough analysis of the life of the bees describing the hive organization, fertilization of the queens and the killing of the drones, theretofore unknown. Later he turned to the study of plants and advanced knowledge of their methods of fertilization. He died near Geneva, Dec. 21, 1831.

HUBERT, ST., French bishop and missionary, is said to have been born of noble parents in Aquitaine during the 8th century. Hunting was one of the favorite sports at the court of Pepin, and Hubert enjoyed it beyond all others. While engaged on one of these hunting expeditions, he suddenly received the grace of conversion, and putting himself in the hands of St. Lambert, became a monk. He later succeeded St. Lambert as bishop. Because of the fervor of his preaching he converted many heathen to the faith. He died about 727. Hubert is revered as the patron saint of hunters and his day is celebrated on Nov. 3.

HUBLI, a city in the Bombay district, British India. It is situated about 15 mi. southeast of Dharwar, on the Madras and Southern Maharatta Railway. Primarily, the city is a trade center for cotton. Pop. 1921, 69,206.

HUC, ÉVARISTE RÉGIS (1813-60), French missionary and traveler, was born at Toulouse, in 1813. As one of the Lazarist Fathers he went to China where he learned the language and began his missionary work. In 1844 he made the difficult journey to Lhasa, the capital of Tibet, which he was forced to leave after a short stay. Returning to France in 1852 he wrote, among other books, his *Souvenirs d'un voyage dans la Tartarie, le Thibet, et la Chine* and *Le Christianisme en Chine.* He died at Paris in 1860.

HUCBALD DE ST. AMANDO (c. 840-c. 930), Flemish monk and musician, was born about 840. He established a singing school in Nevers, and in 872 succeeded his uncle, Milo, as musical director of the St. Amando Monastery. Although GUIDO D'AREZZO is commonly credited with the greatest early achievement in the development of the musical NOTATION, Hucbald anticipated him in basic principles by more than a century, in that he used a group of parallel lines which indicated intervals of various sizes according as the letter *S* or *T* was placed at the beginning of the line as a primitive clef (the letters standing respectively for semitone and tone). He died about 930.

HUCH, RICARDA (1864-), German poet, novelist and critic, was born at Brunswick, July 18, 1864. She was educated in her native town and at Zürich, and later lived in Austria and Italy, finally establishing herself at Munich. Her novels are written in a romantic style. The better known among these are *Aus der Triumpgasse,* 1902, and *Der Grosse Krieg in Deutschland,* 1912-14. Those having a historical background are *Bluthezeit der Romantik,* 1899,

Das Risorgimento, 1908, and *Michael Bakunin,* 1923. Her chief critical work is *Die Romantische Schule.*

HUCKLEBERRY, a name given in the eastern United States and Canada to various small, fruit-bearing shrubs of the heath family. The true or black huckleberry (*Gaylussacia baccata*), found in sandy woodlands from Newfoundland to Manitoba and ranging southward to Georgia, grows from 1 to 3 ft. high, bearing waxy-resinous leaves, green on both sides, pinkish-red flowers and small, sweet, shining, black berries without a bloom. Several kinds of BLUEBERRY (*Vaccinium* sp.), usually with much larger bluish fruit, covered with a grapelike bloom, are frequently called huckleberries. *See also* VACCINIUM.

HUCKLEBERRY FINN, THE ADVENTURES OF, an incomparable tale of life on the Mississippi by Mark Twain (*see* S. L. CLEMENS); published 1885. Humorous, satirical, crammed with the keenest observations, this is the story of the marvelous adventures of the outcast Huck Finn, his friend, TOM SAWYER, and the runaway slave, Jim, who float down the Mississippi together on an improvised raft. Their immortal voyage takes the trio into every phase of the then romantic river life—into showboats, midnight storms, romance and a melodramatic feud.

HUDDERSFIELD, a town of Yorkshire, England, situated on the Colne, 189 mi. northwest of London. It is the chief center of the fancy woolen trade of Britain, and manufactures broadcloths, trouserings and steam engines. The town possesses some fine public buildings: the circular cloth-hall (1768-80), the town hall, an edifice in the classical style, the technical college, and the proprietary college, affiliated with the University of London. The parks are beautifully laid out. Huddersfield was the first town in Britain to own and operate its street railways. The first parish church was erected about 1110 and rebuilt in Tudor times. Roman remains have been found in the vicinity. Pop. (of county borough) 1921, 110,102; 1931, 113,467.

HUDSON, HENRY (c. 1550-1611), English explorer, born about 1550. After two voyages to the Arctic for the English Muscovy Company in search of a passage to Asia, he was offered a good command by the Dutch East India Company and sailed from Texel in the *Half Moon* bound again for the Arctic. Off Spitzbergen his crew became mutinous and he turned southwest for the American continent, coasted south, perhaps as far as the capes of the Chesapeake, and turning northward, entered Hudson River, subsequently named for him, and sailed up beyond tidewater to the junction of the Mohawk above Albany. On his return to England he was punished by the authorities for sailing for the Dutch, but in 1610 he was permitted to sail from London on another attempt to find the northwest passage. He entered Hudson Strait and Hudson's Bay again—waters subsequently named for him though it is doubtful if he was the first to sail them. After wintering in James Bay, apparently near Moose Factory, Hudson set out again northwestward the following spring, but his crew mutinied and on June 22, 1611 placed him, his son, and seven other men in a small boat and cast them adrift. Nothing further is known of them. The mutineers returned to England. Many died on the way and the survivors were imprisoned.

HUDSON, HENRY NORMAN (1814-86), American scholar, was born in Cornwall, Vt., Jan. 28, 1814, and graduated in 1840 at Middlebury College. While teaching school in Kentucky and Alabama he became recognized as an authority on Shakespeare, and published his *Lectures on Shakespeare* and *Shakespeare: His Life, Art and Characters.* After serving as a chaplain in the Civil War, he published *A Chaplain's Campaigns with General Butler,* and later *Studies in Wordsworth* and *Essays in Education.* Hudson died in Cambridge, Mass., Jan. 16, 1886.

HUDSON, WILLIAM HENRY (1841-1922), British naturalist and author, was born at Quilmes, near Buenos Aires, Argentina, Aug. 4, 1841. After spending some years on the Argentinian *pampas,* he went to England in 1874. Although appreciated by a few admirers, Hudson's rare gifts of observation and style were long unrecognized. Poor and in ill health, he rambled the English countryside or lived in his wife's London boarding house. His earlier writings include a collaboration with P. L. Sclater on *Argentinean Ornithology,* 1888, and *British Birds,* 1895. His South American youth was suggested in *The Purple Land,* 1885, and *A Crystal Age,* 1887. In 1901 Hudson received a civil service pension, and in 1904 published his imaginative romance, *Green Mansions.* After this he gradually emerged from obscurity into belated success. Observant studies of the English countryside occur in *Afoot in England,* 1909, and *A Shepherd's Life,* 1910. *Far Away and Long Ago* appeared in 1918, and *Birds of La Plata* in 1920. After Hudson's death in London, Aug. 18, 1922, his posthumous work, *A Hind in Richmond Park,* was hailed by many as the masterpiece of this sensitive and perceptive writer. Hudson's collected works comprise 24 volumes.

HUDSON, a town and village in Middlesex Co., eastern Massachusetts. The village is situated on the Assabet River, 16 mi. northeast of Worcester and is served by the Boston and Maine Railroad and by bus lines. Hudson is an industrial center making shoes, rubber, products, yarn and machinery, and has wool washing and spinning mills. It was founded in 1699 as Howe's Mills, and later changed to Feltonville. The first shoe-making establishment was opened in 1816. Pop. 1920, 7,607; 1930, 8,469.

HUDSON, a city in southeastern New York, the county seat of Columbia Co., situated on the eastern bank of the Hudson River, 30 mi. south of Albany; it is served by bus lines, river craft and two railroads. There are two airports. The chief crops of the region are fruit, grain, potatoes and hay; cement, ice tools and machinery, knitted goods and various other products are manufactured. In 1929 the industrial output was valued approximately at $4,000,000; the retail trade amounted to $8,705,728. The state training school for

girls is located here. The city is beautifully situated between the Catskills and the Berkshire Hills. The Dutch came in around 1750, and merchants and fishermen from New England settled here in 1783. It was known as Claverack Landing until it was renamed for Hendrik Hudson in 1784. Hudson had considerable foreign shipping trade and was a harbor for a flourishing whaling fleet until 1812. Pop. 1920, 11,745; 1930, 12,337.

HUDSON BAY, an inland sea in the northeast of North America, almost landlocked except on the north where Fox Channel lies between it and the Arctic Ocean, and where Hudson Strait, stretching 500 mi. southeast, connects it with the Atlantic. From north to south Hudson Bay extends 1,300 mi., including James Bay, 350 mi., and Fox Channel, 350 mi. Its maximum width is about 590 mi. To the south it narrows into the shallow cul-de-sac of James Bay. The only warm southern currents which offset the influence of the Fox Channel and of Hudson Strait are the many rivers which drain Rupert's Land. Thus, in spite of its moderate latitude and of the luxuriant vegetation of southerly coasts, Hudson Bay is arctic in character, though it cuts the same parallels as Great Britain; and owing to the prevailing north winds the ice is driven southward. The average depth of this inland sea is about 80 fathoms, though James Bay is exceptionally shallow and must be navigated with great caution. At no time of the year is Hudson Bay entirely frozen over; a broad belt of coastal ice forms along the shores, but the central waters are ice-free, apart from drift ice, as is the case in Hudson Strait. James Bay, however, brackish from the waters of the great rivers which flow into it, is usually frozen across by February.

The west coast of the bay from Cape Henrietta Maria in the south to Eskimo Point, some 500 mi. to the north, is flat, but clean-cut and in marked contrast to the island-studded shores of the east coast. The coastal waters are very shallow, and, with the exception of York Roads and Churchill Harbor, are naccessible to ocean-going steamers. North of Eskimo Point the character of the coast changes; it is indented with numerous inlets and the inshore waters are dotted with a belt of rocks, islands and reefs. Northward from York Factory the coastal tree zone is left behind, though the inland tree limit reaches the latitude of Eskimo Point. From Eskimo Point the Barren Lands extend northwards to the Polar Sea on the northern coast of Canada. They consist largely of rolling tundra interspersed with rocky ridges. On the east coast of the bay, with the exception of Port Harrison, there are no known natural harbors suitable for large vessels. On the west coast Fort Churchill, established in 1700, has come into prominence as the terminus of the Hudson Bay Railway, completed in 1930.

HUDSON FALLS, a village in Washington Co., eastern New York, situated on the Hudson River, 58 mi. north of Albany. It is served by canal craft and the Delaware and Hudson Railroad. Dairying is the chief agricultural interest in the region. Hudson Falls has large wall paper and paper bag factories. The village received its present name in 1910. Before this date it was known as Sandy Hill, the name under which it was incorporated in 1810. Jane McCrea, an American woman, was murdered at Ft. Edward, near here, in 1777, by Indian allies of Burgoyne. Charles Evans Hughes lived in Hudson Falls during his boyhood. Pop. 1920, 5,761; 1930, 6,449.

HUDSON RIVER, a river of New York State, heading in Lake Tear-of-the-Clouds in the heart of the Adirondacks at an altitude of 4,322 ft. It descends abruptly over the south slope of the mountains, forming many cataracts and waterfalls and takes a southerly course to its mouth at New York City. After leaving the mountains its slope is moderate except between Glens Falls and the mouth of the Mohawk, where it makes a series of steep drops, furnishing valuable water power. Its length is 315 mi. and its drainage basin, including that of the Mohawk, is 13,366 sq. mi. The tide reaches 150 mi. up the river to the federal dam at Troy, which is the head of navigation. Here it is connected by the ERIE CANAL with Buffalo on Lake Erie.

The Hudson is a fiord type of waterway, being at one time an arm of the sea extending to the St. Lawrence and making New England an island. Its valley was formed by ice erosion and its tidal area is due to the sinking of the land, making it a drowned river near its mouth. The scenery along its course is in many places strikingly beautiful. Below Newburgh it passes through the Highlands, formerly a part of the Appalachian Mountains, and farther down are the Palisades, a steep wall of trap rock from 250 to 500 ft. high and 16 mi. long. At this point the river is a mile wide. The chief cities on its course are New York, Jersey City, Albany, Troy, Poughkeepsie and Cohoes.

HUDSON RIVER SCHOOL OF PAINTING, the name given to a group of American painters who banded together about 1830 in an attempt to produce a national art by direct painting of American landscape. The foundation of the school was laid by ASHER DURAND and THOMAS COLE. Although unhampered by traditions or methods, the group was strongly influenced by the DÜSSELDORF SCHOOL which was then the standard of American art, and where many of these practical painters went for further study. They painted out of doors, deriving their name from the delight they found in the countryside along the Hudson as seen from the Catskill Mountains. Some of the more adventurous went with the first explorers to the Rockies and the Yellowstone, returning with canvases in the panoramic style. But their copying was minute and mechanical, and it was for a later school of colorists, led by Homer Martin and George Innes, to break the spell of the Düsseldorfers and reveal the secret of atmosphere learned by the French BARBIZON SCHOOL. The panoramic style of historic painting on enormous canvases was cultivated by the more ambitious, Emanuel Leutze's *Wash-*

ington Crossing the Delaware and Church's *Niagara* and *Heart of the Andes* being examples. Notable members of the Hudson River School were Kensett, Whittredge, Cropsey, McEntee, Bierstadt and Gifford.

HUDSON'S BAY COMPANY, a British chartered company primarily interested in the fur trade of British North America and the marketing of furs in England. The advices of Radisson and Groseilliers were instrumental in initiating the enterprise chartered by Charles II, May 2, 1670 as the "Governor and Company of Adventurers of England trading into Hudson's Bay." The "adventurers" included Prince Rupert and 17 other noblemen. The charter granted a monopoly of the trade of all lands watered by streams entering the Bay, long thereafter known as Rupert's Land, and of all trade and traffic in adjacent lands which the "adventurers" should enter, and entire civil, legislative, judicial, and executive authority in their trading domain. The original capital was about £110,000. By the middle of the 18th century, posts had been established on James Bay and at the mouths of the Churchill and Hayes rivers, and three or four ships were being annually dispatched from England with trading-stuffs to be bartered for furs collected by the Indians. Conflict with French traders practically ended when in 1713, by the Treaty of Utrecht, France renounced claim to the Hudson Bay region, and until 1763 the company enjoyed a virtual monopoly. Dazzling increases in trade and in territory exploited followed the English conquest of Canada, but concurrently opposition companies invaded the field. The strongest opposition was offered by the NORTHWEST FUR COMPANY, which was absorbed by the Hudson's Bay Co. in 1821. In 1859 the company lost its monopolistic privileges, and by the NORTH-WEST TERRITORIES PURCHASE of 1869 surrendered all its semi-sovereign rights and the greater part of its lands to the Canadian Government. Since the World War the company has shown enlivened activity, and is opening new posts in territories hitherto unexploited.

HUE, the capital of Annam, French Indo-China, situated 10 mi. from the mouth of the Hue River. The city is in two parts, a native market place and a modern quarter. It was strongly fortified by French engineers early in the 19th century. With an extensive arsenal, magazines and walls 60 ft. high and about 120 ft. broad, Hue formerly ranked as one of the strongest military positions in Asia. The manufacture of glass and ivory goods is of some importance. Pop. 1929, 62,800.

HUELVA, a city of Spain, capital of Huelva province situated near the wide mouth of the Odiel River. The regularly built city covers considerable territory. The shipping is extensive, as the excellent harbor, accessible to ocean vessels, handles the exports of the rich copper, manganese and iron ore found in the province. Wine, oil and subtropical fruits are also exported. Est. pop. 1929, 34,000.

HUERTA, VICTORIANO (1854-1916), Mexican dictator and general, was born in Colotlán, Jalisco, Dec. 23, 1854. He graduated from the Chapultepec Military College at the age of 21, assisted Porfirio Diaz in his revolt against President Lerdo de Tejada and continued to have an active part in the military life of Mexico throughout Diaz's regime. When Diaz fell Huerta joined FRANCISCO MADERO and conducted campaigns against Zapata in 1911 and Orozco in 1912. During the "Ten Tragic Days," Feb. 9-18, 1913, he led the Madero forces in Mexico City against those of Felix Diaz entrenched in the Arsenal, when hundreds of noncombatants were killed. Huerta then betrayed Madero and forced Congress to proclaim him President. President Wilson refused to recognize him. Because he objected to a remonstrance of the Congress he had 110 of the deputies arrested and seized the legislative and judicial powers. In Apr. 1914 occurred the Tampico incident. A boatful of American sailors landing to buy gasoline were arrested. Wilson demanded an apology and a salute to the American flag. Huerta refused the salute. Vera Cruz was occupied by American troops. The opposition of Washington and the advance of Carranza's army forced Huerta to resign in July 1914. He left Mexico and died in El Paso, Tex., on Jan. 13, 1916.

HUFELAND, GOTTLIEB (1760-1817), German economist and jurist, was born at Danzig, Oct. 19, 1760. He was successively professor at the universities of Jena, Würzburg, Landshut and Halle. From 1808 to 1812 Hufeland was mayor of Danzig. His chief writings are the *Neue Grundlegung der Staatswissenschaftskunst* and *Lehrbuch des Naturrechts,* which are held to be excellent commentaries on Kant's theory of law. He died at Halle, Feb. 25, 1817.

HUGH, ST. (1023-1109), abbot of Cluny, was born in France about 1023. When only 25 years old, he succeeded St. Odilo as abbot of the monastery at Cluny and, assisted by Pope Gregory VII, served as the head of the great Benedictine Order, one of the first "Father-Generals" of a religious order in the Latin Church. St. Hugh died in 1109; his feast day is Apr. 29.

HUGH CAPET (c. 939-996), King of France and founder of the Capetian dynasty, was born about 939, the son of Hugh the Great, Count of Paris. He became Count of Paris in 956, and inherited from his father the title, Duke of France. It was not until Louis V, the last Carolingian, died in 987 without heirs that Hugh was elected King of France. The ties that bound the powerful vassals of France to their first Capetian sovereign were so weak and precarious that they threatened to snap even at the weak opposition of Charles of Lorraine, the only surviving Carolingian claimant to the throne. But these feudal ties owed their elasticity to their very weakness, and, notwithstanding rebellions on the part of his vassals, betrayal at the hands of the Archbishop of Reims, and the downright enmity of both Emperor and pope, Hugh managed to secure his hold on the throne. He insured the succession by associating his son Robert with him as King, and, by playing on the

weaknesses of his enemies, succeeded in passing on to his son a somewhat strengthened state. Hugh died in Paris, Oct. 24, 996.

HUGHES, CHARLES EVANS (1862-), American jurist and public official, was born at Glens Falls, N.Y., Apr. 11, 1862. Graduating from Colgate University and from Columbia Law School with high honors, he began practice in New York City in 1884. He won wide reputation as attorney for the insurance investigation of 1905, was elected Governor of New York in 1906, and re-elected in 1908. As governor he was responsible for several reforms, the most noteworthy being the creation of a commission to control public utilities, a law prohibiting race-track gambling, and a law providing for the direct primary. In 1910 he was appointed to the United States Supreme Court, resigning in 1916 to become Republican candidate for the presidency. Defeated by Woodrow Wilson, he returned to law practice. In 1921 he was appointed Secretary of State by President Harding. As chairman of the Conference on Limitation of Armament in Washington, 1921, his skillful leadership was influential in bringing about the treaty among the naval powers limiting the building of capital ships. In 1926, having resigned as Secretary of State, he was appointed member of the Permanent Court of Arbitration at The Hague, and in 1928 he was elected by the League of Nations as judge of the Permanent Court of International Justice. In 1930 President Hoover appointed him Chief Justice of the United States. He has delivered a number of university lectures, later published, on international law and foreign relations; and in 1928 he received the Roosevelt medal for work in public and international law.

HUGHES, RAYMOND MOLLYNEAUX (1873-), American educator, was born in Atlantic, Iowa, Jan. 14, 1873. He studied at the University of Miami, Ohio State and Massachusetts Institute of Technology, and in 1898 returned to Miami as a member of the faculty. There he served successively as professor of physics and chemistry, dean of the college of liberal arts, and, beginning in 1913, as president. In 1927 he resigned to become president of Iowa State College.

HUGHES, RUPERT (1872-), American author, was born in Lancaster, Mo., Jan. 31, 1872 and studied at Western Reserve University and at Yale. He did editorial work in London, New York City and elsewhere. In 1916 he served in the army on the Mexican border, and in the World War was promoted to the rank of major. Hughes's numerous and popular writings include novels, such as *The Patent Leather Kid* and *Ladies' Man,* plays, motion picture scenarios, and a biography of George Washington.

HUGHES, SIR SAM (1853-1921), Canadian statesman, was born at Darlington, Ont., on Jan. 8, 1853. He studied at Toronto University. In 1885 he bought the Lindsay *Warder,* which he edited until 1897; in 1899-1900 he served in the Boer War. He was appointed minister of militia and defence in 1911 in Borden's cabinet. After the outbreak of the World War, Hughes rendered valuable service in mobilizing and organizing volunteer Canadian troops to go to England. He was made a major-general in 1915. He resigned in 1916 through a disagreement with Borden. He died at Lindsay, Ont., on Aug. 24, 1921.

HUGHES, THOMAS (1822-1896), English author and statesman, was born in Uffington, Berkshire, Oct. 20, 1822. After graduating at Oxford, he studied law and began practicing in 1848. Eight years later he published *Tom Brown's School Days,* a story of public school life, based on his own experiences at Rugby. (*See* TOM BROWN.) This book made him famous and was much more popular than his succeeding works such as *Tom Brown at Oxford* and *Alfred the Great.* Hughes was active in movements for social reform, and served as a Liberal Member of Parliament in 1865-74. He died at Brighton, Sussex, Mar. 22, 1896.

HUGHES, WILLIAM MORRIS (1864-), Australian statesman and labor leader, was born in Wales, Sept. 25, 1864. When a young man, he moved to Australia, where he worked as a laborer. He became active in labor organizations and in 1894 was elected to the legislature of New South Wales. Seven years later he became a member of the Federal legislature, and in 1904 was appointed minister of foreign affairs. He served as premier of Australia from 1915 to 1922.

HUGH OF GRENOBLE, ST. (1053-1132), French bishop and Church reformer, was born near Valence in Dauphine about 1053. He was appointed bishop of Grenoble in 1080, and received consecration at the hands of St. Gregory VII in Rome. Simony and usury infected the Church administration of the time and St. Hugh acted vigorously to end these evils. He died in 1132, and his feast is kept on Apr. 1.

HUGH OF LINCOLN, ST. (1140-1200), bishop of Lincoln, was born in Burgundy about 1140. He became a priest, then procurator and finally, because of his growing reputation for holiness and organizing ability, was persuaded by Henry II to continue his labors in England. There he became bishop of Lincoln and won so powerful a position that he was able even to oppose the policies of the king with impunity. St. Hugh died in France in 1200. He was canonized in 1220, and his day is celebrated on Nov. 17.

HUGO, VICTOR MARIE (1802-85), French poet, dramatist and novelist, was born at Besancon, Feb. 26, 1802, his father, Capt. J. L. S. Hugo, being in the service of Napoleon. His early life was spent in accompanying his father to garrisons in Spain and Italy, but in 1815 he settled in Paris where he received the more formal part of his education. At the age of 20 he published a collection of odes and found himself famous, the great CHATEAUBRIAND himself designating him "the sublime boy." In 1823 came his first romance, *Han d'Islande,* and two years later another, *Bug-Jargal.* His literary reputation was so completely established by 1822 that Louis XVIII granted him a pension, although Hugo was only 20. Poems, plays and romances followed in rapid succes-

sion, for Hugo was a writer whose versatility was only equalled by his extraordinary fertility of invention. *Cromwell,* 1827, *Les Orientales,* 1829, *Le Dernier jour d'un Condamné,* 1829, *Hernani,* 1830, *Marion De Lorme,* 1829, *Le Roi s'amuse,* 1832, *Ruy Blas,* 1838 all reflected his genius and won for him recognition as one of the world's great poets. With the production of his poetical tragedy *Hernani,* he established a new school of French drama, overthrowing the supremacy of the classical tradition and establishing the right of romanticism to a place in the French theater. In 1831 NOTRE DAME DE PARIS was published, this romance at once placing Hugo among the elect as a prose writer, apart from his standing as a poet.

Hugo did not confine his activities exclusively to literature. Politics also attracted him. Beginning his adult career as a royalist, he became increasingly liberal in his views, and so violent was his opposition to the accession of Napoleon III that it led to his exile. He first lived in Brussels and later on the islands of Jersey and Guernsey. Literary works continued to flow from his pen. Political satires against "Monsieur Bonaparte" (as he chose to speak of Napoleon III) and, in 1859, his magnificent *Légende des Siècles,* a poem picturing the "blossoming of the human race from century to century," were followed by LES MISERABLES, 1862, *Les Travailleurs de la Mer,* 1866, *L'homme qui rit,* 1869, and in 1874, *Quatre-vingt-treize.* The last four are evidences of Hugo's vitality as novelist.

After an exile of 20 years, he returned to Paris in 1872, following the downfall of Napoleon III. He was 70 years of age, but the fertility of the poet was not yet exhausted. In 1877 he published another series of the *Légende des Siècles* and the next year wrote a beautiful poem, *L'Art d'être grand-père.* In politics he joined the extreme republicans and was regarded as one of their leaders. Perhaps never in any country or at any time has a literary man reached such heights of glory and of public veneration and acclaim. The splendor of his lyricism, the extraordinary sweep of his inspiration, the glamor and picturesqueness of his romances, his powers of pathos, his marvelous fertility of invention, and his preeminence in both prose and poetry, won for him readers in every land. Hugo's novels are marred by exaggerations of emotional feeling and by digressions that sometimes became wearisome. But these are relatively minor when viewed in the light of his phenomenal qualities. He died at Paris, May 22, 1885, and was awarded a public funeral. He was buried at the Pantheon, in the pauper's coffin he had requested.

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HUGO, a city and the county seat of Choctaw Co., situated in southeastern Oklahoma about 10 mi. from the Red River and 200 mi. southeast of Oklahoma City. Farm crops and fruit are produced in the vicinity. The local industries include cotton ginning, cottonseed oil manufacture, the making of creosote and railroad shop work. Pop. 1920, 6,368; 1930, 5,272.

HUGUENOTS, the term applied to French Protestants of the reformed or Calvinistic communion. The term was originally applied as a nickname and as an epithet of reproach, denoting foreign heretics residing in France. The precise etymology is obscure, and there are more than a dozen hypotheses extant as to the derivation of the name. The Huguenots in France corresponded very closely in manners and thought to the Puritans of England. They were noted for the austerity of their lives and for the purity and severity of their moral precepts. Although they suffered persecution during the reigns of Francis I and his successors, they were powerful enough to resist, and for several generations after 1562 were frequently at war with the Catholics. The Huguenots belonged chiefly to the smaller nobility, but their leaders were from the first families of France; such as Admiral Coligny and the King of Navarre, afterwards HENRY IV of France. One of their severest reverses was the infamous Massacre of St. Bartholomew, which took place on Aug. 24, 1572. Henry IV in 1598 issued the famous EDICT OF NANTES that secured to the Huguenots full political, civil and religious rights and the privilege of garrisoning certain fortresses. They grew in numbers, in prosperity and in influence until their political power was attacked by Richelieu in 1626 and crushed with the capture of La Rochelle, in 1628. Their misfortunes culminated in the revocation of the Edict of Nantes by Louis XIV in 1685. Severe persecutions forced multitudes of Huguenots to flee to the various Protestant countries of Europe; many of them braved the dangers of the New World, settling in South Carolina and elsewhere along the Atlantic seaboard.

HUGUENOTS, THE, an opera in five acts, usually condensed to three, by GIACOMO MEYERBEER, libretto by Eugène Scribe; première, Paris, 1836, New Orleans, 1839, New York, 1850. The story dealing with the St. Bartholomew massacre of 1572, is dramatically handled, the composer producing what is generally deemed his finest opera.

Hoping to put an end to the differences between the Catholics and Huguenots, Queen Marguerite de Valois seeks to unite the Huguenot nobleman, Raoul de Nangis, with Valentine, the daughter of the Catholic leader, St. Bris. Unaware of her identity, Raoul had previously saved Valentine's life, and both are infatuated with each other; but he is led to believe that Count de Nevers, a Catholic nobleman, has been too intimate with her. He consequently puts the girl from him, and she in turn marries de Nevers before Raoul learns of her innocence from Queen Marguerite. To confirm this truth he goes to the home of de Nevers to see Valentine who hides him when footsteps are heard approaching. Almost at once de Nevers and St. Bris enter, discussing their plan to murder all Huguenots that very night, though de Nevers demurs to this action. No sooner are they gone than Raoul leaps from his hiding place and

dashes into the street to warn the Huguenot leaders. Valentine joins him. De Nevers has been slain and she now is free to marry her adoring Raoul. But he refuses if to marry he must become a Catholic. Valentine therefore decides to embrace the Huguenot faith and die with him. A volley rings out and Raoul and Valentine fall under it before St. Bris, heading the band of soldiers, discovers that he has murdered his daughter.

HUISACHE (*Acacia Farnesiana*), a much-branched, spiny shrub of the pea family, called also opopanax, popinac and cassie, widely grown as an ornamental. Native probably to America, it is now naturalized in all tropical countries and occurs in the southern United States. It grows 6 to 10 ft. high bearing smooth, finely divided leaves, large round heads of deep yellow flowers and cylindric pithy pods. In France, where the shrub is extensively cultivated, the very fragrant flowers are used in perfumery.

HULL, ISAAC (1773-1843), American naval officer, was born in Derby, Conn., Mar. 9, 1773. He early followed his bent for the sea, starting as cabin boy at the age of fourteen. He developed rapidly into a skillful navigator and when twenty-one was commanding a merchant vessel. Upon joining the U.S. Navy in 1798, he was for some years lieutenant on the *Constitution*. He fought in the war with Tripoli, in command of the *Argus,* and in 1806 became captain. At the outbreak of the War of 1812 was put in command of the *Constitution*. In August, 1812, he distinguished himself by winning the first victory of the war in his capture of the British frigate *Guerrière*. He was later made a commodore, and after the war commanded American squadrons in foreign cruises. In the latter part of his life he had charge of the navy yards at Boston and New York. He died in Philadelphia, Feb. 13, 1843. *See also* CONSTITUTION.

HULL, a city and the capital of Hull Co. and district, and a railroad junction in Quebec, Canada, lying across the Ottawa River from Ottawa with which city it is connected by three bridges. The Chaudiers Falls of Ottawa supply hydroelectric power to Hull and its large match and cement works, paper, pulp and saw mills. Since it was swept by fire in 1900, the city has been largely and well rebuilt. Originally an Indian meeting-place, the site was visited by Champlain, and in 1800 settled by Philemon Wright and pioneer families from Woburn, Mass. Hull was incorporated in 1875. Pop. 1921, 24,117; 1931, 29,443.

HULL, or KINGSTON-UPON-HULL, a city and port of Yorkshire, England, 175 mi. north of London. It is one of the older ports of England, though its antiquity does not reach back to Roman times. It is said to have been founded by Edward I, who built a town here called King's Town. Hence came the full name of the town, Kingston-upon-Hull, Hull being properly the name of a small river which enters the Humber estuary at the point where the city stands, 22 mi. from the North Sea.

The docks comprise an area of 200 acres, accommodating a large German and Scandinavian over-sea trade. The chief exports are woolens, cottons, coal, oil and machinery; imports are cattle, grain, wool, flax, iron and timber. Shipbuilding and engineering plants, tanneries, oil-cake mills and rope works are located here. Hull was one of the first ports in England to engage in whaling, an enterprise now abandoned; but its fisheries employ large fleets.

There are three splendid public parks and many fine buildings in the city. Two famous churches are Holy Trinity, with a central tower 140 ft. high, and St. Mary's Lowgate, 1,333, one-half of which was removed to make room for the mansion house of Henry VIII, who stayed here in 1540. The most important educational establishments are Hull and East Riding College and Hull Grammar School, 1486, where ANDREW MARVELL was educated.

During the civil war Hull was held by the parliamentary forces, and was twice besieged without success. Pop. 1921, 290,681; 1931, 313,366.

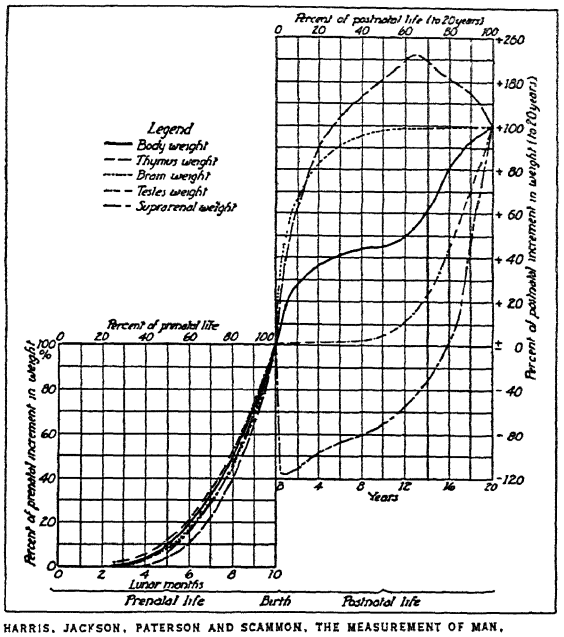
HULLERS are used principally on alfalfa, clover, beans, peas, oats and rice. The most common types rub the seed from the pods or husks. In the case of alfalfa, clover, beans and peas, hulling is usually associated with threshing, while with some crops it is a part of the manufacturing process. *See also* CLOVER HULLERS; THRESHERS.

HULME, THOMAS ERNEST (1883-1917), English philosopher, was born at Gratton Hall, Edon, North Staffordshire, Sept. 16, 1883. He studied at St. John's College, Cambridge, but in 1904 was forced to leave on account of a brawl. His restless spirit rebelled against the routine and formality of university life. Although readmitted to Cambridge in 1912 with the help of Henri Bergson, Hulme was unable to pursue his studies in a regular manner. When the World War came he enlisted and was killed near Nieuport, Sept. 28, 1917. Hulme left behind a mass of notes from which the volume entitled *Speculations,* 1924, has been compiled. In it may be found the fragments of some six works the author had planned. He was interested in the philosophy of art and was out of sympathy with any philosophical viewpoint looking toward unity.

HULUTAO, the port on the northwest shore of the Liaotung Gulf, South Manchuria, which the Chinese are developing as a terminus for their railways in western Manchuria and as a rival to Japanese-controlled DAIREN. Work was started in October, 1910, on a plan to provide harbor facilities for deep-water vessels by dredging, constructing a breakwater, etc. The contract for the work was let to British interests. Failure on the part of the Chinese to make the payments required, and the revolution of 1911, led to the suspension of the work a year after it was started. In January, 1930, a new contract, with a Dutch syndicate, was signed and work was renewed in the summer of 1930, only to be suspended in 1931 when the Japanese occupied Manchuria in the autumn of that year.

HUMAN GROWTH. Growth in size and complexity of the human body proceeds from the moment of conception through the first 20 years of post-natal life. The increase in length, weight and surface area of the entire body or any segment is observed by direct measurements of the external dimensions on living individuals or on roent-genograms of bones and internal organs. The pre-natal growth of all parts of the body shows a rapid and steady increase throughout the ten embryonic and fetal months. Post-natal growth, however, is of four distinct types.

First, the *general type,* made up of four phases: (1) a rapid rise in infancy and early childhood; (2) slow but constant increase from 3 to 12 years of age; (3) acceleration at puberty; (4) a slow period before



HARRIS, JACKSON, PATERSON AND SCAMMON, THE MEASUREMENT OF MAN, UNIVERSITY OF MINNESOTA PRESS

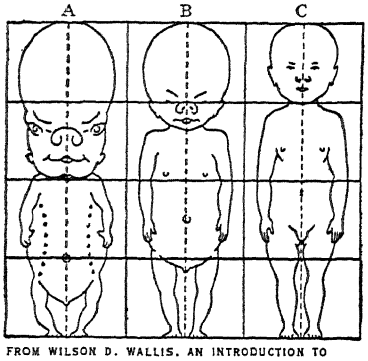
DIAGRAM ILLUSTRATING THE GROWTH IN PRENATAL AND POST-NATAL LIFE OF A SERIES OF STRUCTURES OF DIVERSE POST-NATAL TYPES OF GROWTH

complete maturity. Weight, stature, the dimensions of the trunk and limbs, the kidney, spleen, heart, pancreas and liver all grow in this fashion. Graphically, the general type of growth is represented by the familiar S-shaped or double sigmoid curve.

Second, the *neural type* has only two phases: a rapid increase in infancy, and a very slow growth from early childhood until maturity. This is characteristic of the brain, the spinal cord and the head and face.

Third, the *lymphoid type,* consists of a rapid gain in infancy, a continual but slow increase until puberty, and then an actual decrease in size of the organ. The thymus gland and other organs composed of lymphoid tissue grow and then shrink in this way.

Fourth, the *genital type.* Following a very slight increment in infancy, the organs do not increase in size from the first until the eleventh year when very rapid growth takes place through the pre-pubertal and adolescent periods. The testes, the prostate gland and most other parts of the male genital system, and the ovaries and various parts of the female genital tract conform to this pattern.

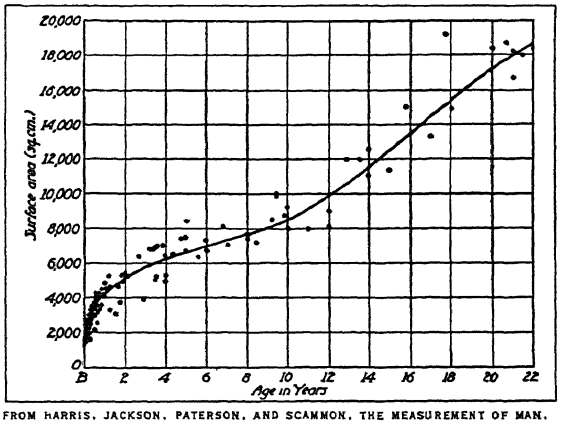


FROM WILSON D. WALLIS, AN INTRODUCTION TO ANTHROPOLOGY, HARPER & BROS.

BODY PROPORTIONS OF THE HUMAN INFANT

A, *At two months of pre-natal development;* B, *at five months of pre-natal development;* C, *at a month after birth*

The order in which the parts of the body attain their final growth follows the so-called "law of developmental direction." In each fetal month and each year of post-natal life, the head has completed a larger percent of its mature size than has the trunk, and the trunk is more mature than the leg length.



FROM HARRIS, JACKSON, PATERSON, AND SCAMMON, THE MEASUREMENT OF MAN, UNIVERSITY OF MINNESOTA PRESS

COURSE OF GROWTH OF THE BODY IN SURFACE AREA IN POSTNATAL LIFE

Field graph and curve of central tendency: The dots represent individual determinations of surface area by various observers. The curve of central tendency is drawn by inspection to the median values for the periods from birth to six months, six months to one year, one year to two years, and for two-year periods from two years to maturity

The human growth period differs from that of other animals most conspicuously in the great length of the juvenile period with its low rate of increment and the relatively late arrival of puberty.

Factors most strongly influencing individual growth are heredity in widely separate race groups or in family lines, environment which by quality of nu-

trition and severity of "children's diseases" brings about acceleration and retardation, and age, sex and stature. That with age every individual grows except under conditions of peculiar pathology is obvious. Sex differences mainly center around the earlier acceleration of the female in size, ossification and dentition and the longer, slower growth and final greater magnitude of the male. Individual stature influences growth from fetal life to maturity, often determining the size and maturity of other parts of the body more surely than does age. Tall individuals have a shorter and more intense growth period; short individuals grow more slowly over a longer period and reach their age of maximum increment later. Our knowledge of human growth is based largely on mass measurements at different ages. The present tendency is to obtain repeated measurements of individuals over as long a time as possible. R. S. WA.

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HUMANISM, a phase of the pragmatic movement in philosophy. It places emphasis upon the human aspect of things, and in its thinking insists on keeping the human factor which is implicated in experience and knowledge always in sight. It does not think of humanity as an abstraction, feeling that it is the concrete living human beings that must be considered. The human equation is reckoned with in judgments of evaluation whether in the realm of logic, ethics or religion. The term has recently crept into religion to designate an attitude which places emphasis upon the values of this life rather than the search for them in some other world. The will of God in human affairs is interpreted in terms of the interests of man.

HUMAN PIGMENTATION. *See* SKIN PIGMENTATION, HUMAN.

HUMAN TEETH, ANTHROPOLOGICAL ASPECTS OF. *See* TEETH, HUMAN.

HUMAWHI, a sub-tribe of the North American Shastan linguistic stock which occupied formerly the south fork of the Pit River, Modoc Co., Cal. They are related to the ACHOMAWAI.

HUMBER, an estuary formed by the junction at Faxfleet, England, of the rivers Trent and Ouse. From Faxfleet the Humber flows first eastward for about 20 mi., and then turns southeast for an equal distance before it reaches the North Sea. It is 1 mi. wide at its head and about 8 at its mouth. Open to large vessels, it is connected by a system of canals with the main streams of England.

HUMBERT I (1844-1900), king of Italy called "the Good," was born at Turin, Mar. 14, 1844. He was the son of Victor Emmanuel II, whom he succeeded Jan. 9, 1878, choosing to be known as Humbert I of Italy. His reign was comparatively quiet, its outstanding event being the formation in 1882 of the Triple Alliance between Germany, Austria-Hungary and Italy. He was assassinated by the anarchist Bresci at Monza, July 29, 1900.

HUMBOLDT, FRIEDRICH HEINRICH ALEXANDER VON (1769-1859), German naturalist, born in Berlin, Sept. 14, 1769. In 1797 he published his study of muscular reactions under the title *Versuche über die Gereizte Muskelund Nervenfaser.* A scientific treatise dealing with the formation of deposits along the Rhine, entitled *Uber die Basalte am Rhein, nebst Untersuchungen über Syenit und Basanit der Alten,* was published in 1790. His study of the atmosphere, *Versuche über die Chemische Zerlegung des Luftkreisses,* 1799, added much to our knowledge of the composition of the air. In 1799 was begun the famous voyage to South America, Mexico and Cuba which was to be so fruitful in gaining a better knowledge of these regions. The expedition left Coruna in 1799 and landed at Bordeaux in 1804. From 1807 to 1827 Humboldt was occupied in relating the results of this voyage. The Russian government appointed him in 1829 to make a study of its Siberian regions, which resulted in the finding of the Ural Mountain diamond deposits. His most systematic work, largely speculative in character, appeared between 1845 and 1858 under the title *Kosmos.* By travel and investigation Humboldt laid the foundation for the sciences of physical geography and meteorology. He died in Berlin, May 6, 1859.

HUMBOLDT RIVER, the longest river of Nevada, rising in the northeastern part of the state. It flows west and southwest for 350 mi. and terminates in Humboldt Lake in the western part of Nevada. This river is only a few yards wide and grows smaller by evaporation toward its mouth. Its course is across a series of uplifts forming the Basin ranges, but usually the river passes through broad gaps rather than canyons. Its waters are saline. The drainage basin comprises 32,148 sq. mi. and is flanked by rugged peaks, some of which are 11,000 ft. high. This area is best suited to grazing, although where irrigated the land produces good crops of alfalfa and hay. The course of the Humboldt is paralleled by the Southern Pacific Railroad.

HUME, DAVID (1711-76), British philosopher, historian and essayist, was born at Edinburgh, Apr. 26, 1711. He was educated at Edinburgh and twice applied for a professorship there but was refused this appointment. Finally in 1752 he became librarian at the Advocates' Library. He was also for a time a diplomat, being appointed Secretary to Gen. St. Clair in 1746. In 1748 he accompanied St. Clair on missions to Vienna and Turin. Later as secretary to Lord Hertford he made a similar visit to Paris in 1763. He died in Edinburgh Aug. 26, 1776.

Hume's *Treatise on Human Nature,* 3 vols., 1739-40, was later published under the following titles: *An Enquiry Concerning Human Understanding,* 1748; *Dissertation on the Passions,* and *Enquiry Concerning the Principles of Morals,* 1751; *Essays, Moral, Political and Literary,* 1751. His *History of England,* 6 vols., 1754-63, was much better received than his philosophical writings. It is interesting to note that subsequent generations have reversed this judg-

ment. Hume the historian is now eclipsed by Hume the philosopher. His history was written with a Tory bias and a hatred of all things Whiggish. It does have the virtue, however, of being one of the early works to incorporate a social viewpoint. *The Natural History of Religion* appeared in 1755 and the *Dialogues Concerning Natural Religion* were published posthumously, 1779.

With Hume British empiricism reached its height. It was Hume's scepticism that awoke IMMANUEL KANT from his dogmatic slumber. Both the categories of substance and causality had been undermined by this bold and daring thinker. Self was thought of as nothing but a bundle of sensations and impressions, while causation was reduced to a mere customary relationship possessing none of the elements of necessity. Hume himself admitted that he could not live in the kind of a world which logic led him to construct. Politically Hume was an opponent of the social compact theory of the state.

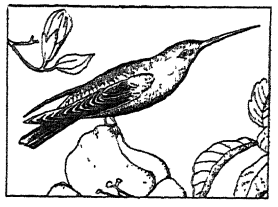
HUMIDITY, a term applying to the amount of moisture in the air. It is sometimes spoken of as the *absolute humidity* and again as the *relative humidity.*

The absolute humidity means the actual mass of water present in a cubic meter of air under normal conditions, while the relative humidity is the ratio between what is actually present and what would be present if it were saturated. The amount of moisture present in the air we breathe is very important. American homes are heated in such a way that the relative humidity is far too low for health and comfort. It is far more comfortable in air having the proper moisture content at 64° to 66° F. than in the usual dry air at 70°-72° F. This lower temperature for the home would also mean a saving in fuel bills.

It has also been demonstrated that people are more free from colds when the proper moisture is present in the air they breathe than when it is dry. This is a point which should be carefully considered in the building and heating of our homes. S. R. W.

HUMILIATI, or **BARRETTINI,** so called from their headdress, a penitential order begun early in the 12th century by Lombard nobles in German captivity. On being released, they brought to Italy the benefit of advanced German methods in the woolen industry and organized trades unions in many communities. Their first monastery was established at Milan in 1134. Under the Benedictine Rule, they were approved by Pope Innocent III about 1200, but abuses caused their suppression in 1571. Wives of the original Humiliati founded, under Clara Blassoni, a branch, "Hospitalers of the Observance," and worked among lepers. A few houses have survived in Italy.

HUMMING BIRD, a member of the exclusively American family *Trochilidæ.* This includes the smallest of all birds, but few exceeding 4 in. in length. Except the rubythroat of the eastern United States, and 17 species in the Southwest, none is known north of Mexico, while about 500 different kinds inhabit the tropics. Some are confined to the river-valleys; others ascend high mountains. These tiny creatures take their name from the whirring sound of their wings when they hover before a flower as if in a mist, and their flight is a series of almost invisible darts. All have very long, sharp beaks, and double-tubed tongues. Their food is mainly nectar and minute insects found in flowers. Female humming birds are metallic green above and white below, but the males are dressed in the brightest and most resplendent colors, many having throat gorgets, or crests, or wing and tail ornaments, so that they gleam like gems in the sunshine. Their nests are tiny cups of down and the eggs of all species are two in number and pure white. E. I.



HUMMING BIRD

HUMMING-BIRD MOTH, many moths of the family *Sphingidæ* are popularly so called, also known as hawk-moths and sphinx-moths. Many species are large, beautifully marked insects. They fly at twilight, poising over flowers while sucking the nectar. A whirring sound is produced meantime by the rapidly moving wings. The sucking tube is very long, enabling the moths to feed on tubular flowers such as the petunia, datura and tobacco. Larvæ which are naked caterpillars, usually possessing a horn near the caudal end of the body, are leaf feeders.

HUMPED OX. *See* ZEBU.

HUMPERDINCK, ENGELBERT (1854-1921), German music composer, was born at Siegburg, Sept. 1, 1854. After studying at the Cologne Conservatory he did supplementary work under Lachner and Rheinberger. In 1879 he met RICHARD WAGNER, whom he assisted in the production of *Parsifal.* He taught at the Barcelona Conservatory and in 1890 joined the faculty of the Frankfort Conservatory, ten years later going to the Berlin Meisterschule. In 1905 he visited the United States, where he supervised a revival of his most noted opera, HANSEL AND GRETEL. Other operas by this composer are *Die Königskinder, Dornröschen,* and *Die Heirat wider Willen.* He also composed a group of songs, *Kinderlieder,* and incidental music to Shakespeare's *Merchant of Venice, Winter's Tale,* and *The Tempest,* Aristophanes's *Lysistrata,* Maeterlinck's *Blue Bird,* and Vollmoller's *The Miracle.* He died at Neu-Strelitz, Sept. 28, 1921.

HUMPHREY, SIR GILBERT (c. 1539-83), English soldier, navigator and colonist, was born near Dartmouth, Devonshire, about 1539. On his mother's side he was a half-brother of Sir Walter Raleigh. Gilbert was educated at Eton and Oxford. He was a firm believer in the existence of a northwest passage and in 1587 he set out on a voyage of discovery which proved unsuccessful. Again in June, 1583, he sailed from England with five ships and succeeded in establishing the first English colony in North America near the harbor of St. John's, Newfoundland. Gilbert was drowned off the Azores, when his ship sank, Sept. 9, 1583.

HUMPHREY CLINKER, a character in *The Expedition of Humphrey Clinker.* by TOBIAS SMOLLETT. He is brought up in a parish work house and after being dismissed from several menial tasks takes service with a fretful gentleman, Mr. Bramble. He falls in love with Mr. Bramble's maid and turns out to be Mr. Bramble's illegitimate son.

HUNA, a sub-tribe of the TLINGIT of the Koluschan linguistic stock, living on Cross Sound in Alaska, with summer villages up to and beyond Lituya Bay.

HUNCHUN, a border town of Manchuria, northeastern China, lying near the point where the Siberian and Korean frontiers meet that of China. Its chief exports are farm products, beans and game. Owing its existence to its use as a military post in 1714, Hunchun expanded until it was important enough to open to trade, an act performed by the Manchurian Convention in 1905. Customs were organized four years later. Pop. 1929, 37,535.

HUNDREDWEIGHT, a unit of weight equivalent to 100 POUNDS in the United States and 112 pounds in Great Britain. Twenty hundredweight comprise a short TON in United States units and a long ton in British units.

HUNDRED YEARS' WAR, a series of intermittent but disastrous struggles between England and France, lasting from 1338 to 1453. The pretext for the conflict was dynastic. Although Louis X, John I, Philip V and Charles of France all died without issue, the SALIC LAW was invoked in order to bar Isabella and her son Edward III of England from the throne of France. For this reason the Crown passed to Isabella's cousin, Philip VI of Valois. There were other causes of friction. The fact that the English king held Gascony and Guienne was a constant source of irritation to the French monarch, who retaliated by supporting Scotland against England, while quarrels over Channel fisheries and rival interests in Flanders, upon which England depended as a wool market, kept relations between the two Governments tense.

The war was fought at sea and on land. At the Battle of Sluys, 1340, the English ships, supported by archers on board, totally defeated a large French navy, thereby securing control of the seas for the time. At the outbreak of the war France could put 40,000 men into the field, while Edward could summon only 8,000 men-at-arms. He, therefore, sought alliances with the Holy Roman Empire and with the burghers of Ghent, led by Jacques van Arteveld. For the first few years fighting was desultory, but in 1346, with a reorganized army in which much dependence was placed upon yeoman soldiery armed with the long bow, Edward won a signal victory over French knights and Genoese cross-bowmen at Crécy, and the next year successfully besieged Calais. His son, the Black Prince, triumphed similarly at Poitiers in 1356. This period of the war was terminated by the Treaty of Brétigny, 1360, by the terms of which Edward waived his claim to the Crown of France and the Duchy of Normandy, but retained Aquitaine, with Calais and other lands, not as a French fief but in absolute right. Of these possessions the Black Prince became regent. Friction in Aquitaine led to a resumption of hostilities in the course of which the Black Prince died and England lost all her possessions on the Continent except the three seaports of Calais, Bordeaux and Bayonne, together with the Channel Islands. Partially as a result of continual warfare, partially as an aftermath of the BLACK DEATH, both countries were torn with internal discontent culminating in France in the JACQUERIE and the risings under Etienne Marcel, and in England in WAT TYLER'S REBELLION.

In 1395 Richard married Isabella of France and a truce was made for 25 years. In 1404, however, France assisted Owen Glendower against England, and the situation was further unsettled by the insanity of the King, Charles VI. Henry V then raised again the claim to the French Crown. He invaded Normandy in 1415, captured Harfleur, was hard pressed by a superior French force but escaped annihilation by winning a brilliant victory at Agincourt. Allied with John, Duke of Burgundy, he again invaded Normandy, capturing Rouen. The treacherous murder of the duke during the invasion drove the duke's son, Philip, and the French Queen into the arms of the English. The TREATY OF TROYES, 1420, marked a further truce in hostilities. Henry married Katharine of France, was appointed regent for his father-in-law, the mad Charles, and was declared heir to the French throne. But Charles and Henry died in the same year, 1422, when Henry's son was one year old. The regent of France was the late king's brother, John, Duke of Bedford, who displayed the genius of his family. With the assistance of the Duke of Burgundy, he proceeded to complete the conquest of northern France. By the inspiration of JOAN OF ARC, the French were galvanized into action. The siege of Orleans was raised, the brother of Katharine was crowned Charles VII at Reims, and the English were driven from French soil. By 1453, Calais alone remained to the English, which they retained until 1558.

HUNEKER, JAMES GIBBONS (1860-1921), American musician, critic, and author, was born at Philadelphia, Pa., Jan. 31, 1860. He was educated as a lawyer, but abandoned his profession to study piano and composition with Mathias and Joseffy, becoming the latter's assistant at the National Conservatory, New York. He was a vigorous critic, and his wit and originality gained him a large audience. His numerous books on music include *Overtones, Iconoclasts, Ivory, Apes and Peacocks,* and his autobiography, *Steeplejack.* He died at New York, Feb. 9, 1921.

HUNGARIAN GRASS, a name widely given in the United States to a purple-headed variety of fox-tail MILLET cultivated for hay and forage.

HUNGARIAN LANGUAGE, an important member of the Ugric branch of the FINNO-UGRIC linguistic family.

Its closest affinities are with Ostyak and Vogul,

spoken east of the Ural Mountains. Its word-accent falls on the first syllable. In consonantism it is much more archaic than FINNISH, and, like the other members of the group, it is characterized by VOWEL-HARMONY. It has only one declension, and the case-endings are the same both in singular and plural, the plural sign being *k* or *i*, the latter used before a possessive suffix. Of the case-endings, only the accusative *-t*, the superessive *-n*, the essive *-ul*, *-ul*, and the factative *-va*, *-ve* are original, the others having arisen later from postpositions. The verb has two conjugations, subjective and objective, and three moods: indicative without modal sign; conditional with *-na-*, *-ne-*; and imperative with *-j-*. Instead of the old preterite with *-a-* or *-e-*, Modern Hungarian uses the perfect with *-tt-* or *-t-*, while the old future with *-and-* or *-end-* has been replaced by a compound form. Unlike Finnish, the negative particle *nem* does not take verbal endings. Hungarian verbs used various prefixes to express different aspects (*see* ASPECT), but morphologically it has lost a dual form still possessed by Ostyak and Vogul. B. J. O.

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HUNGARIAN LITERATURE. The literature of Hungary was late in developing, due to the fact that Latin was the language of the educated classes up to the 15th century. The native language, Magyar, belongs to the Finno-Ugrian group, which includes the Finnish, Lapp and Turkish languages. The only early productions in Magyar are a few songs, legends and a 13th century funeral oration. The chief Magyar writings of the 15th century are translations of the Scriptures. The establishment of a press at Buda in 1473 was an important event in the development of Hungarian letters. The Reformation largely dominated the literature of the 16th century, and numerous writers engaged in religious controversy. The three most important lay writers were the lyric poet, Balassa, the minstrel, Tenódi, and the dramatist, Karádi. The Reformation and Counter-Reformation in the 17th century inspired the prose writings of Cardinal Pazmany; of other writers the most important was Nicholas Zrinyi (1618-64), epic poet and author of *Zrinyiász;* also of note was the publication of a Hungarian encyclopedia in 1653 and of a dictionary in 1708. A period of stagnation followed the Peace of Szatimár, 1711; the only important writers during the next 60 years were Clemént Mikes (1690-1762), author of *Letters from Turkey*, and Francis Faludi, a Jesuit, who wrote excellently in prose and verse.

The Literary Revival. A period of regeneration began in Magyar literature in 1772, when George Bessenyei published his brilliant poem *Az embernek probaja*, in the manner of Alexander Pope's *An Essay on Man*. The French Revolution shook Hungary into literary activity, and many newspapers and magazines suddenly came to life. The outstanding writers of the new period were Andrew Dugonics, who wrote national romances; Francis Kazinczy, a poet noted for his odes and as the author of *The Orpheus*, 1790; Charles Kisfaludy (1788-1830), a founder of Hungarian drama, and his brother, Alexander Kisfaludy (1772-1844), ranked as the first notable romantic poet of Hungary; the dramatist, Joseph Katona (d. 1830); the poet Ferencz Kolcsey (d. 1828); and the historian and poet, Benedict Virág (1752-1830). Of special importance was the patriot, Count Stephen Széchenyi (1791-1860), who was largely responsible for the founding of the Hungarian Academy of Sciences in 1830 and the National Theatre at Pest in 1837.

Modern Literature. The 19th century was indeed rich in Hungarian writers of unusual talent. In poetry three names stand out above all others, SÁNDOR PETÖFI, JANOS ERDÉLYI and John Arany. The novel was brought to perfection in the hands of MAURUS JÓKAI, BARON JOZSEF EÖTVÖS and Sigismund Kemény (1814-77), "the Balzac of Hungary." The most lustrous names in the drama were Charles Bernstein (1817-77), Joseph Bajza (1804-58), Gregory Czicky (1842-90) and Edward Tóth (1844-76). In the 20th century Hungarian literature has developed apace in both quantity and importance. National and cosmopolitan influences have been at work, and activity has been remarkable in poetry, the drama and particularly in the field of the novel.

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HUNGARY, an independent kingdom of central Europe, bounded on the west by Austria, on the north by Czechoslovakia, on the east by Rumania and on the south by Yugoslavia.

Surface Features. Hungary embraces an area of 35,875 sq. mi., the surface being mostly plateau and plain. The country is crossed from north to south by two main river systems, the DANUBE and the Tisza. The Danube descends from Austria; and from Pozsony to Esztergom, a distance of over 100 mi., marks the frontier between Hungary and Czechoslovakia. East of Esztergom the Danube makes a sharp turn southward and flows through the middle of Hungary, reaching Yugoslav territory near Bezdan. The Tisza has its sources in Czechoslovakia and after receiving many tributaries follows a course southward almost parallel to that of the Danube. East of the Danube extends the great Hungarian plain, famed for the fertility of its soil. Lake Balaton in western Hungary is one of the largest in Europe.

Population. Hungary's population in 1930 was 8,742,000. The bulk of the population is Hungarian (Magyar). There are approximately 500,000 Germans, 150,000 Slovaks, 40,000 Croatians and 25,000 Roumanians. BUDAPEST, the capital and largest city, which is situated on the banks of the Danube River, had a population of 1,004,699 in 1930. The populations of other chief cities of Hungary were: Szeged, 135,000; Debrecen, 117,000; Kecskemet, 79,000; Hódmezö-Vásárhely, 60,000; Miskolc, 61,000; Ujpest, 67,000; Kispest, 64,000, and Györ, 50,000.

Religion and Education. One of the fundamental laws of the Hungarian state is religious tolera-

tion. This allows a variety of creeds to thrive. More than half of the population, however, is Roman Catholic. In 1928 the principal religious groups were: Roman Catholics, 5,541,048; Greek Catholics, 201,964; Helvetian Evangelicals, 1,786,349; Augsburg Evangelicals, 529,029; Jews, 476,338.

Hungary has made rapid progress in education. Illiteracy, which before the World War was widespread, has been constantly declining during the last decade; and whereas in 1910 one-third of Hungary's population was unable to read or write, estimates show that only about 10% is illiterate. In the school period of 1927-28 there were in Hungary 6,618 elementary schools with 747,686 pupils and a teaching staff of 17,628. Higher and special training is provided by numerous secondary schools, colleges and technical and art academies. There are state universities in Budapest, Szeged, Pecs and Debrecen. In 1927-28 the total number of students attending the four universities was 10,348, and their combined teaching staff consisted of 586 members.

Production and Industry. Hungary is primarily an agricultural state, two-thirds of the land being in an arable condition and nearly 60% of the population actively engaged in its cultivation. Before the World War a considerable part of the Hungarian land was held in large estates by individual landlords, but since the establishment of the new kingdom much of it has been broken up into smaller holdings. Hungary produces a variety of agricultural products, of which the chief are wheat, maize, rye, barley, oats and potatoes. In 1930 the output of these crops in quintals was as follows: wheat, 22,953,426; maize, 14,070,649; potatoes, 18,414,465; barley, 6,010,245; oats, 6,185,900. Large tracts of the Hungarian land are devoted to gardening, vineyards and the growing of various fruits. In fact the gardeners of Hungary are famed throughout Europe. Likewise the raising of livestock has always been an important item of Hungarian agriculture. The horses of Hungary are especially noted. In 1929 Hungary had almost 1,000,000 horses, twice as many cattle, 1,500,000 sheep and 2,500,000 pigs. Though there are large deposits of bauxite, Hungary is not rich in minerals. Coal and iron are the only important minerals exploited. In 1930 the total output of coal was 6,985,658 tons.

The industries of Hungary are dependent upon the agricultural products of the country. Flour milling is the principal industry and is centered in Budapest where there are many modern mills. In all important cities there are hundreds of smaller mills. Quantities of maize, potatoes, sugar beets and other agricultural products are used for distillation. Sugar refining is also conducted on a large scale. Other important industries are the manufacturing of hardware, machinery, agricultural implements, rolling stock, bricks, cement, cigarettes and cigars, boats, glassware and the refining of oil. On the Danube and the Tisza there are extensive and profitable fisheries. In 1928 Hungary had about 3,500 industrial establishments of all kinds, employing nearly 250,000 people.

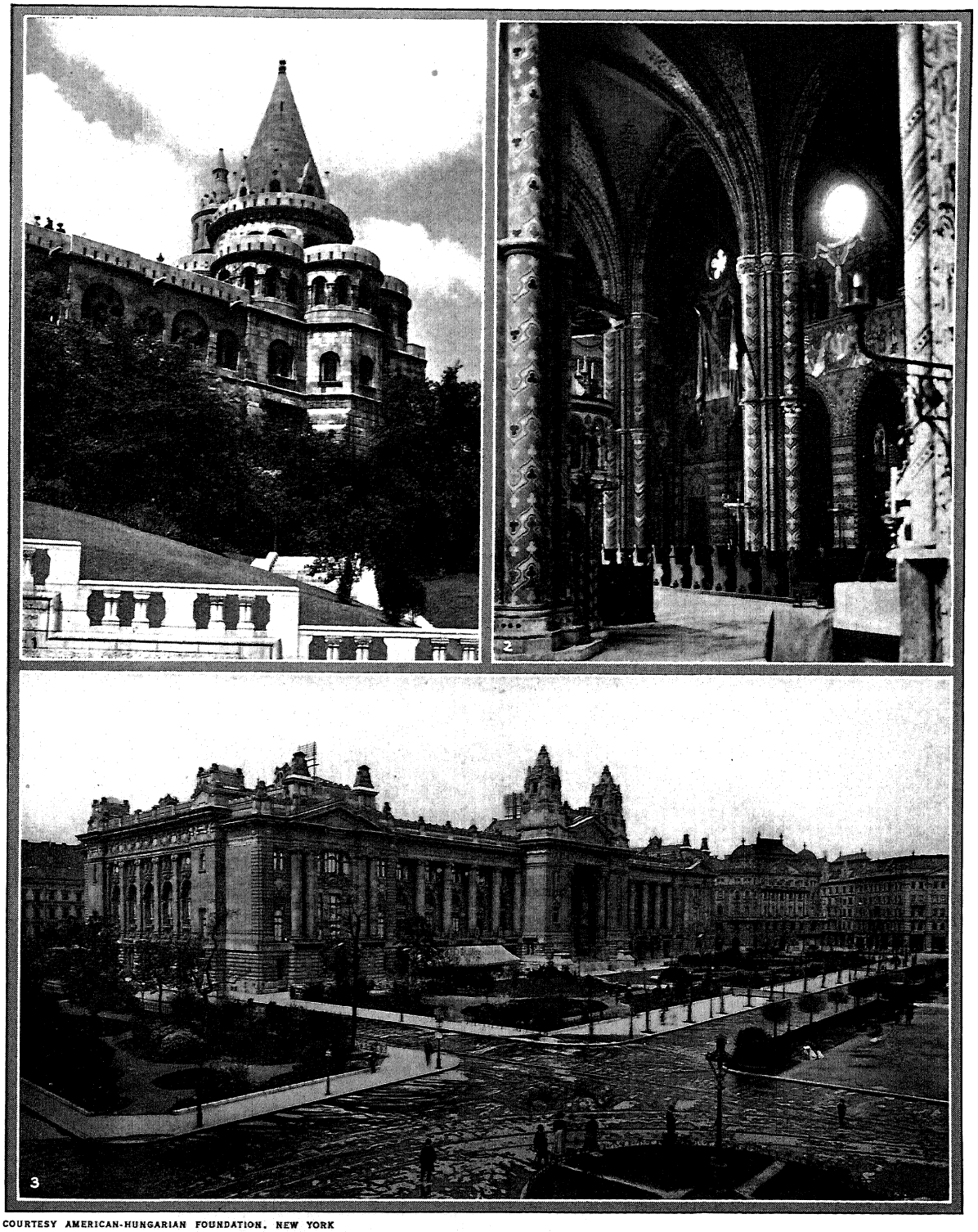
Transportation and Trade. Hungary has two railway systems, one, the more important of the two, owned and operated by the state, and one belonging to a private corporation. The country is spanned by a network of lines and may be said to be the best provided with railway facilities of all the central European states. Nearly all trunk lines issue from Budapest. Besides, the Danube is navigated by large vessels through every mile of its Hungarian course. In 1928 there was also a total of 17,785 mi. of state and municipal roads. The total mileage of both private and government-owned railways in the same year was 5,388 mi.

The foreign trade of Hungary is chiefly with Austria, Czechoslovakia, Germany and Italy. The principal exports are flour, wheat, animals, sugar, rye, eggs, wool and machinery. The imports include timber, coal, cotton and woolen fabrics, paper and paper goods, metals and mineral oil. In 1930 the total value of the exports was 910,431,000 *pengos* and of the imports 832,947,000 *pengos*.

Finance. The monetary unit of the Hungarian state is the *pengo,* which is equal to $0.1748085. The National Bank of Hungary, founded in 1924, issues the currency, of which in Oct. 1929 there were 525,517,725 *pengos* in circulation. One of the successor states of the dismembered Austro-Hungarian Empire, Hungary inherited some of the debts of the empire and was in addition burdened with heavy reparation payments by the Paris peace treaties. The total public debts of Hungary in 1928 amounted to 1,455,003,530 *pengos*. In 1930, the expenditures amounted to 1,428,671,400 *pengos,* while the revenue was 1,432,171,400, leaving a surplus of 3,500,000.

Government. Hungary is a constitutional monarchy, but the throne is vacant and the functions of the monarch are performed by a regent, Admiral Nicholas Horthy. The people retain the right to solve their dynastic problem as soon as conditions become more settled. The Hungarian Legislature consists of an Upper and a Lower House. The Upper House is composed of elected representatives of former hereditary members, heads of various religious groups, high dignitaries of the state, representatives of scientific and commercial institutions, representatives of the county councils and municipalities and members appointed for life by the head of the state. The members of the Lower House are elected by direct vote by the people at large. The somewhat complicated local administration in Hungary is now under reform. Counties and certain municipalities with their own representative bodies, committees and elected executives still possess a large measure of autonomy. Yet there is much interference in their administrative affairs by the central government.

The judicial system consists of district courts, courts of justice and courts of appeal. The Supreme Court of Budapest is the highest judicial tribunal in the land. Petty misdemeanors are dealt with by magis-



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BUDAPEST, CAPITAL OF HUNGARY

1. Fisher Bastion, overlooking the Danube, Buda. 2. Interior of the Coronation Church, dating from the 15th century, where King Francis Joseph was crowned in 1867. 3. The Bourse, or stock exchange.

trate courts. Active military persons are under the jurisdiction of military tribunals.

HUNGARY, HISTORY OF. The people of this compact state on the middle Danube are called Magyars. They belong to the Asiatic, that is, non-Aryan stock, and are kin to the Finns, Bulgars and Turks. They entered middle Europe in the 9th century, and under the leadership of a somewhat legendary hero, Arpad, crushed the kingdom of Moldavia and pushed on up the Danube basin driving the Slav tribes back from the river. Their marauding parties struck terror and destruction as far west as the Rhone valley. In 933 the advance was temporarily checked by Henry the Fowler, and in 955, a severe defeat at the hands of Otto the Great not only checked them again, but established a sort of western boundary in the region of Pressburg, on the Danube for Magyar settlement. From this time on they settled south and east along the great river, occupying all of the rich middle Danube valley, and gradually becoming a stable agricultural people.

During the latter part of the 10th century Christian missionaries began work among the Magyars, and under the first King, St. Stephen, of Hungary, who was crowned in 1000, they definitely accepted Christianity. During Stephen's reign of 43 years, 997-1038, Hungary came into close contact with the civilization of Europe and made rapid progress. Stephen cultivated contact with the west, accepted coronation at the hands of the Pope's representative, and in return recognized the Pope as his suzerain. Many Germans immigrated into the country, contributing a good deal to its organization. The bishoprics were established, and the country was divided into counties for governmental and political administration. At the same time Stephen's successors acquired more territory, including Croatia and parts of Dalmatia. Toward the end of the 11th century, however, disintegrating forces threatened the kingdom, from which it was saved by the wise rule of Ladislaus, 1077-95. By degrees a powerful landed aristocracy (magnates) grew up who extorted from King Andrew II, after his return from his crusade in 1217, the Golden Bull, a sort of Magna Charta, as the basis for the privileges of the Hungarian nobility.

After the extinction of the Arpád dynasty with Andrew III, the House of Anjou, 1308-82, gained control of Hungary and succeeded in uniting the thrones of Hungary and Poland in 1370 during the remarkable reign of Louis the Great, 1342-82. Louis I was succeeded by his son-in-law, Sigismund, 1387-1437, who became Emperor of the Holy Roman Empire in 1410. During the half century of his reign, the kingdom declined, Sigismund becoming more and more interested in imperial matters, to the neglect of Hungary. At the same time serious danger from another quarter began to threaten Hungary, in the Turkish invasion of southeastern Europe. The Turks had crossed over from Asia Minor in the 14th century, had overrun Macedonia and made invasions into Serbia and Bulgaria. From there they were pushing north and west, threatening Croatia and Dalmatia. To prevent this, Sigismund brought together a large army, and engaged the Turks in a great battle at Nicopolis on the Danube in 1396. Because of dissensions among his followers, however, he was defeated in a fiercely fought battle which only failed to be decisive against the Christians because the Turks were being attacked by Tamerlane in Asia Minor, and had to withdraw their armies to defend themselves at home.

In 1438 Albert, duke of Austria, who had married Sigismund's only daughter, succeeded him but he died within a year while fighting the Turks. The Hungarian nobles then invited Ladislaus of Poland to become King. He accepted the crown, but in 1444 he too was killed in a battle against the Turks at Varna. The minor son of Albert was then crowned King, as Ladislaus V. In the meantime, John Hunyadi, the great national hero of Hungary, acting as regent, organized the Christian armies and defeated the Turks. But in 1448 he was in turn defeated by them at Kossovo. Nothing daunted, he continued the struggle and in 1456 forced Mohammed II, who had conquered Constantinople in 1453, to raise the siege of Belgrade and retreat to Adrianople. Hunyadi died in 1456, and the death of King Ladislaus a little later again left the throne vacant. The Magyars elected Hunyadi's son, Matthias Corvinus, King, 1458-90. His reign of 32 years constitutes the most brilliant period in Hungarian history. He consolidated and united the nation and won great victories over the Turks, successfully holding them back from the Danube countries. At home he fostered learning and good government, lifting Hungary to a place of outstanding prominence among the states of Europe.

Turkish Invasions. Matthias was succeeded by Ladislaus II of the House of Jagiello under whom Bohemia was united to Hungary. But factional strife developed again, seriously weakening the nation, making her an easy prey for the watchful and aggressive Turk. In 1526 King Louis II and the flower of the Magyar nobility were cut down in the great defeat at the hands of Suleiman the Magnificent on the field of Mohács. It is estimated that over 20,000 Magyars were slain. The victorious Turks now pushed up the Danube to Buda, the Hungarian capital. Thousands of Magyars were carried off and the country laid in ruins. Mohács gradually became a sort of symbol of disaster among the Magyars, one of their popular folk songs turning on the oft repeated theme "But what matter! More was lost at Mohács field." By 1541 all of lower Hungary with Buda had been conquered, and for a century and a half the Turkish menace remained. For a time upper Hungary too was in their possession, Suleiman supporting the cause of John Zápolya, who had been chosen by some of the Magnates in opposition to Ferdinand of Austria, the choice of the other party. Vienna itself was besieged in 1529 by Suleiman.

During the next century religious difficulties were added to the political, the Hungarians demanding and

obtaining extensive privileges, both political and religious, from the Habsburg rulers. The withdrawal of these privileges and the rights of local government associated with them led to an uprising of the Magyars under Count Tököly, who appealed to the Grand Vizier of the Turks, Kara Mustapha, for aid. In the war which followed Turkish armies again overran Hungary and almost captured Vienna in 1683. Relief came through the timely appearance of John Sobieski and Charles of Lorraine. After relieving Vienna, Charles of Lorraine and John Sobieski, the King of Poland, continued the war against the Turks with great vigor, Charles winning a great victory at Mohács in 1687. The Turks were driven out, and a large part of Hungary was reconquered by the Austrians. Austria's prestige was greatly heightened, and at the diet at Pressburg the Magyars were obliged to agree that the Crown of Hungary should be for all time hereditary in the Austrian House of Habsburg. Supported by the German princes, the Austrians and the Magyars under Prince Eugene continued to press the Turks, winning a second great victory in 1697 at Zenta.

Subjection to Austria. By the terms of the Peace of Carlowitz, which followed in 1699, Hungary and Transylvania were freed and added to Austria. From this time forward the history of Hungary continues to be intimately associated with that of Austria. During the 18th century the Magyars arose repeatedly to assert their liberties, despite the fact that they loyally supported Maria Theresa in her wars against Frederick the Great. The attempts of Joseph II to introduce reforms and bring about uniformity in the administration throughout his dominions aroused bitter resentment in Hungary, which was further stimulated by the example of the French Revolution later.

With the growth of the spirit of nationality in the 19th century, Hungarian nationalism revived rapidly. Extraordinary leaders like Kossuth arose, and demanded the ancient liberties of Hungary. In Apr. 1848 these were granted and Hungary was again to enjoy home rule. Unfortunately, however, dissensions developed among the Hungarians themselves, while the reactionary forces in Austria, aided by the army, suppressed the liberal movements in the rest of the Austrian Empire in the summer and autumn of 1848. Ferdinand I abdicated, and Francis Joseph I who succeeded him refused to recognize the concessions, while the Hungarian diet declined to recognize the new sovereign. An Austrian army entered Hungary, and in Mar. 1849 the new Emperor proclaimed the Austrian Constitution which abolished the ancient Constitution of Hungary. Thereupon the diet deposed Francis-Joseph and proclaimed Hungary independent and a republic. In the war which ensued the Magyars were completely crushed by the Austrians, aided by an army sent by the Tsar of Russia. Kossuth fled to Turkey, Hungary was soon completely reduced, her Constitution taken away and both Croatia and Transylvania separated from her.

Dual Monarchy. But the spirit of independence survived, and in 1866, after the severe defeat by Austria at the hands of Prussia, the Hungarians refused to be governed from Vienna. The result was the establishment in 1867 of the Dual Monarchy with Hungary, including Transylvania, Moravia and Croatia, as a separate kingdom, with a Constitution and government of its own at Budapest, but forming a part of a dual state in which the Austrian Empire was the other member. The two states were to have the same person as ruler, but in Hungary, Francis Joseph was King, not Emperor, as in Austria; they were to have also common ministers of foreign affairs, finance and the army. Each Government was to appoint 60 members to form the Delegations to consider matters common to both parts of the monarchy. The tariff quota, the National Debt and other matters were adjusted by what is known as the *Ausgleich,* or Compromise, which was to be revised every 10 years. At each renewal the relations between Hungary and Austria over these questions became very strained, often threatening to break up the dual arrangement. The most serious difficulties, in Hungary however, arose from the discontent of the non-Magyar elements, the Croats and Transylvanians, because of the ruthless policy of Magyrization adopted by the Government after 1867. *See* AUSTRIA-HUNGARY.

Independence After World War. During the World War, Hungary found her own nationalistic ambitions closely in accord with that of Austria against the western Slavs supported by Russia. The Magyars fought hard, till the autumn of 1918, when the Dual monarchy collapsed. Revolution broke out in Hungary on Oct. 31, 1918. On Nov. 16, King Charles abdicated, and on the 18th, Hungary was proclaimed an independent Republic with Count Karolyi as provisional President. This lasted till Mar. 22, 1919, when the Communists under Bela Kun set up a Soviet Government and proclaimed the dictatorship of the proletariat. Opposition Governments were, however, promptly set up, and by August, the Soviet Government was swept aside with the aid of the Rumanian army. Elections on the basis of universal suffrage were held. They resulted in a complete victory of the conservatives. The deputies decided to regard the revolutions of 1918 and 1919 as *de jure,* non existent, and resolved that Hungary should continue a monarchy with representative institutions. The throne being vacant, Admiral Nicholas Horthy was appointed to carry on the functions of the monarch, as Regent, until such time as the people, freed from external pressure, could decide the dynastic question.

In the meantime, the area and population of Hungary had been greatly reduced by the Allied Powers in the Treaty of Trianon, June 4, 1920, the Hungarian representatives ratifying this on Nov. 13. By the treaty she lost the important territories, Transylvania, Slovakia, Croatia, Slavonia and west Hungary, to the surrounding states. From a state of 20,000,000 people with an area of 125,000 sq. mi., she was reduced to a small land locked state of 8,000,000 with only

35,000 sq. mi. of territory, and over 3,000,000 Magyars find themselves outside the contracted frontiers.

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HUNKERS, members of the conservative faction of the Democratic party in New York State, 1843-53. The name, perhaps derived from the localism "on one's hunkers," meaning to be in a crouching position, was a derisive characterization of the party regulars as respectable, dull and of petty interests. The Hunkers, unlike the opposite faction, the BARN BURNERS, had no strong convictions on the slavery question. Their dominant interest was in the retention of office and the maintenance of party organization, and to that end the group combined with the Southern Democracy in the national elections of 1844 and 1848. Horatio Seymour, William L. Marcy, and Daniel S. Dickinson were leading hunkers.

HUNKPAPA, one of the bands of the Teton division of the Siouan-speaking DAKOTA INDIANS.

HUNS, Asiatic nomads whose original home was near the western Chinese border. After suffering long from their depredations the Chinese finally took the offensive against them, and early in the 2nd century pushed them into central Asia. From there the Huns moved slowly westward, absorbing other Mongoloid tribes in the process. By the end of the 3rd century they had formed two groups, the White Huns in modern Turkestan, and the Huns known to Europe. The latter made their way westward north of the Caspian Sea during the 4th century and attacked the Ostrogoths in 375. They were described by contemporaries as fierce, undersized savages, without written language or urban life. After overwhelming the Ostrogoths they pushed the Visigoths westward and occupied the lower Danube, receiving tribute from the eastern emperor. The Roman general, Aetius, enrolled thousands of them in his army. By 432 they had spread over Pannonia. Under their famous chief, ATTILA, they subjugated neighboring tribes and invaded western Europe, crossing the Rhine into Gaul in 451. After sacking several Gallic cities they advanced toward Orleans, but were checked by Aetius at Chalons, 451. (*See* CHALONS, BATTLE OF.) The following year they ravaged northern Italy, but were turned back by the intercession of Pope Leo the Great and the promise of a yearly tribute. On the death of Attila in 453 the subjugated tribes broke away and the Hunnic empire collapsed. The remnant returned to Asia and disappeared from history.

HUNT, JAMES HENRY LEIGH (1784-1859), English poet, essayist and journalist, was born at Southgate, Oct. 19, 1784. As a child he wrote poetry and at 20 began to write dramatic criticism and contribute to newspapers. With his brother he started a newspaper which he made the medium for his lifelong battle for liberal ideas and movements in literature and politics. He was fined and imprisoned for two years for criticising the Prince Regent, afterward George IV. Among Leigh Hunt's poems are *Foliage, The Story of Rimini,* and a satire, *Feast of the Poets.* Some of his short pieces, such as *Abou Ben Adhem* and *On a Lock of Milton's Hair,* are famous. His best work is in his essays and his *Autobiography.* He did an immense amount of journalistic and hack work, and was the friend of Shelley, Byron, Keats and other well-known figures of the early 19th century. The latter part of his life was spent in ill-health and poverty. He died at Putney, Aug. 28, 1859.

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HUNT, RICHARD MORRIS (1828-95), American architect, was born at Brattleboro, Vt., Oct. 31, 1828. At the age of 15 he began the study of architecture, and in 1848 became one of the first American students at the Ecole des Beaux-Arts in Paris. In 1854 he helped in the construction of the buildings connecting the Louvre with the Tuileries, and aided in the design of the Pavillon de la Bibliothèque. He returned to America in 1855, opening in New York a school of architecture. Both his school and his work exercised a very strong influence on the development of architecture in the United States. He was one of the founders of the American Institute of Architects, and was long its president. He designed the Marquand chapel and Theological Library at Princeton University; the Divinity School, Yale; the pedestal of the Statue of Liberty in New York Harbor; the Yorktown Monument; the old Tribune building, the original building of the Metropolitan Museum, and the Lenox Library (now demolished) in New York; the Naval Observatory at Washington; and many notable private houses. He died at Newport, R.I., July 31, 1895.

HUNT, WILLIAM HOLMAN (1827-1910), English Pre-Raphaelite painter, was born at London, Apr. 2, 1827. With J. E. MILLAIS and DANTE GABRIEL ROSSETTI he founded the Pre-Raphaelite Brotherhood in 1848, whose aim was an artistic return to the simplicity of the early Italians. (*See also* PRE-RAPHAELITE MOVEMENT.) Hunt's most famous picture is *The Light of the World,* painted 1854, at Keble College, Oxford. The painter visited the Holy Land and Syria in 1854, and in 1875 returned to Jerusalem. *The Finding of our Saviour in the Temple* and *The Triumph of the Innocents* are the most important post-Palestine canvases. Hunt died at London, Sept. 7, 1910.

HUNT, WILLIAM MORRIS (1824-79), American painter, was born at Brattleboro, Vt., Mar. 31, 1824. He studied at the Academy of Düsseldorf, and for 5 years worked under Couture. He was influenced by J. F. Millet, and he introduced the methods of the BARBIZON SCHOOL when he returned to America in 1855. Hunt established an art school in Boston. One of his pupils, Helen M. Knowlton, made a collection of his criticisms and sayings which she published in 1875-82 as *Talks on Art.*

Hunt's chief paintings include *The Farmer's Return, Sheep Shearing at Barbizon, The Fortune-Teller* and *The Prodigal Son*. In the Boston Museum are *Girl Reading, Peasant Girl at Barbizon, Marguerite* and *Hurdy-Gurdy Boy*. The Metropolitan Museum, New York, has *Landscape, Girl at a Fountain* and *The Bathers*. Hunt painted portraits of many prominent persons, as well as decorations in the State Capitol at Albany. The artist committed suicide at the Isles of Shoals, Sept. 8, 1879.

HUNTER, FREDERICK MAURICE (1879-), American educator, was born at Savannah, Mo., Mar. 24, 1879. He graduated from the University of Nebraska in 1905 and took his Ed.D. at the University of California in 1925. From 1905-11 he was superintendent of town schools; from 1911-12 professor of agricultural education at the University of Nebraska, and from 1912-17 superintendent of schools at Lincoln, Neb., and 1917-28, at Oakland, Cal. In the latter year he became chancellor of the University of Denver.

HUNTER, JOHN (1728-1793), surgeon and anatomist, was born on February 13, 1728, at Long Calderwood parish of Kilbride, Lanarkshire. Hunter came to London in 1748, and was put at dissecting by his accomplished brother William. At the year's end he was teaching anatomy and following surgery under Cheselden and Pott. He was staff surgeon with the army in 1761, and there acquired his extraordinary knowledge of gunshot wounds. He solved the problems of the descent of the testes in the fetus, traced the nasal and olfactory nerves in the nose, and discovered the tear ducts. He demonstrated the fact that digestion stops in hibernation, introduced artificial feeding by means of a flexible tube passed into the stomach, and invented an apparatus for forced respiration. His greatest introduction in surgery was the establishment of the principle that aneurysms due to arterial disease should be tied high up in healthy tissues by a single ligature. This displaced the old method of tying the aneurysm with two ligatures and evacuating its contents. It is said that Hunter found surgery a mechanical art and left it an experimental science. Hunter died on October 16, 1793, while attending a board meeting at St. George's Hospital. At the time of his death he had an immense museum, having devoted much of his time to dissecting different species of animals, which was finally purchased by the British government.

M. F.

HUNTER, WILLIAM (1718-1783), British physiologist and physician, the first great teacher of anatomy in England, born May 23, 1718, at East Kilbride, Lanarkshire, an elder brother of the even more famous John Hunter. In 1746 he started a course of private lectures on dissecting, operative surgery and bandaging, and eventually became the leading obstetrician and consultant in London. He gave to the city of Glasgow a museum worth about £100,000. His greatest work is his atlas of the pregnant uterus, published in London in 1774. His discovery of the decidua reflexa and the separate maternal and fetal circulation, in which his brother had a part, is the foundation of modern knowledge of placental anatomy. He was first to describe arteriovenous aneurysm and one of the first to recommend the tapping of ovarian cysts.

M. F.

HUNTER COLLEGE OF THE CITY OF NEW YORK, an undenominational college for women, municipally controlled and supported by funds appropriated by the City of New York, was founded in 1870 as Normal College for the training of teachers. The name was changed in 1914 in honor of Thomas Hunter, the institution's first president. Only residents of New York City are eligible for admission. The library contains 37,085 volumes. In 1930 there were 7,507 students and a faculty of 400, headed by Pres. James M. Kieran.

HUNTERS' LODGES, secret organizations known as Hunters and Chasers in the Eastern Frontier and Lodges of Patriotic Masons, formed in the states along the Canadian border, from Maine to Wisconsin, to abet the anti-British agitation in Canada. (*See* Rebellion of 1837.) Membership, contingent upon an oath "never to rest until all tyrants of Great Britain cease to have any Dominion or footing whatever in North America," included refugees from the Rebellion as well as Americans of democratic principles. A national convention, meeting at Cleveland in 1838, planned the conquest of Upper Canada. Of the several raids which followed, the most serious occurred at Prescott, Nov. 11, 1838. About 200 filibusterers seized and held for several days a windmill on the Canadian side of the St. Lawrence, the skirmish resulting in heavy casualties. Twelve participants were eventually hanged by the Canadian authorities. On Dec. 4, 1838, 400 lodge members attempted to capture Windsor, but were forced back to Detroit by Canadian soldiery. Webster estimated the strength of the lodges at 10,000.

HUNTING, the pursuit of game for pleasure or profit. Among the ancient Egyptians, hunters were a separate caste who either hunted for themselves or as the professional attendants of the nobles. Hunting was a popular sport with the Assyrian kings; lion hunting from chariots having been apparently a favorite sport. Among ancient hunters, the spear, javelin and bow were the chief weapons.

Modern hunters pursue their prey on both land and water. Whales are sought for oil; seals and polar bears for fur. Other deep sea animals systematically hunted include walrus, porpoise and shark. On land, besides the savage tribes which still hunt for food, there are those hunting as a business from the arctic circle to the tropics. Millions of dollars worth of furs are taken annually in the colder climates, and zoological gardens all over the world are stocked anew each year from the wilder countries of both north and south.

There are almost as many methods of hunting for sport as there are varieties of game animals and birds. In England and Europe, game birds and animals are driven by beaters to where the sportsmen

are standing; but in America and Africa, still hunting, or tracking and stalking the game, is more usual. Waterfowl are shot from blinds placed in convenient spots along the shore or from low draught boats which can navigate the marshes.

Dogs of several breeds are used in bird hunting, and hawks and falcons are sometimes trained for this purpose. In England especially the fox and otter are hunted with hounds, the fox being hunted on horseback. The elephant is used in tiger hunts in India, where the swift cheetah is trained to bring down antelope. Tame ducks and geese act as decoys for waterfowl, and ferrets are used to capture rabbits and burrowing animals. *See also:* GAME HUNTING; BIG GAME HUNTING; NIGHT HUNTING; BIRD SHOOTING; PARTRIDGE SHOOTING; PHEASANT SHOOTING; QUAIL SHOOTING; DUCK SHOOTING; SHOOTING; TRAP SHOOTING; GAME AND FISH LAWS; GUNS AND RIFLES; SPORTING; ANIMAL TRAPPING; WOODCOCK SHOOTING.

HUNTINGDON, a borough in central Pennsylvania, the county seat of Huntingdon Co., situated on the Juniata River, 34 mi. east of Altoona. It is served by two railroads. The river is a source of industrial power in the manufacture of silk, radiators, stationery, blank books and other commodities. Huntingdon is in an agricultural district. Coal, limestone and iron are found in the vicinity. Near by are large areas of lumber, under State control. The borough is the seat of Juniata College and of the State Industrial Reformatory. Pop. 1920, 7,051; 1930, 7,558.

HUNTINGTON, ARCHER MILTON (1870-), American Hispanic scholar, born in New York, Mar. 10, 1870, and privately educated in New York and Spain. He was employed by the Spanish government to conduct excavations of the ancient Roman city, Italica, and in 1904 he founded the Hispanic Society of America to which he gave a building, an endowment and a valuable collection. His *Note Book in Northern Spain* appeared in 1898. He later edited and published *The Poem of the Cid* and *Lady (Aulnoy's) Travels into Spain.* In Sept. 1928, he donated $100,000 to the National Sculpture Society for the development of American sculpture.

HUNTINGTON, HENRY EDWARDS (1850-1927), American railway official, was born in Oneonta, N.Y., Feb. 27, 1850. He began railroad work under his uncle, Collis P. Huntington. In 1900 he was made first vice-president of the Southern Pacific System, and soon afterward gained control of and consolidated the street railroad lines of Los Angeles. By making numerous extensions, he developed one of the largest interurban systems in the country. Later he organized the Pacific Light & Power Co. He left his remarkable collection of art and his fine library to the public, establishing a trust fund to support it and to aid artistic and literary research. He died at Philadelphia, May 23, 1927.

HUNTINGTON, HENRY E., LIBRARY AND ART GALLERY. *See* HENRY E. HUNTINGTON LIBRARY AND ART GALLERY.

HUNTINGTON, SAMUEL (1731-96), American jurist, was born at Windham, Conn., July 3, 1731. He established law practice at Norwich, Conn., and in 1775 was elected to the Continental Congress, of which he was a member until 1783, and in 1776 signed the Declaration of Independence. He was elected governor of Connecticut in 1786, in which post he served until his death at Norwich, Conn., Jan. 5, 1796.

HUNTINGTON, a city and the county seat of Huntington Co., Ind., situated on the Little Wabash River, 25 mi. southwest of Fort Wayne. Its transportation facilities include the Erie and the Wabash railroads, motor bus service and an emergency landing-field. The surrounding district is agricultural and is rich in limestone. Huntington has numerous manufactures. In 1929 the factory output reached approximately $10,000,000; the retail trade amounted to $8,456,589. The United Brethren Church maintains Huntington College (established 1897). Huntington, founded about 1831 by Capt. Elias Murray, was incorporated in 1848 and chartered as a city in 1873. Pop. 1920, 14,000; 1930, 13,420.

HUNTINGTON, an industrial and largest city of West Virginia and county seat of Cabell Co., 45 mi. west of Charleston. It is situated in a hilly region on the Ohio River, near the junction of West Virginia, Kentucky and Ohio. The Chesapeake and Ohio, which maintains large shops here, and the Baltimore and Ohio railroads, steamboat and bus lines, and two neighboring airports serve the city. Huntington's industrial interests are promoted by abundant resources of coal and gas, and include glass and bottle-works, and factories for monel metal, iron, steel, and wood products. In 1929 the manufactures reached about $30,000,000; the retail trade amounted to $33,082,462. There are in Huntington a state asylum for the insane, Marshall or State Teachers' College (1837), the second largest educational institution in the state, a State Orphans' Home for Negroes and a Detention Home for Negro girls, and a spacious athletic stadium. In 1932 a million dollar Veterans' Hospital was under construction. At Barboursville, 8 mi. east, is Morris Harvey College (1888). The city was planned in 1871 by Collis P. Huntington, builder of the Chesapeake and Ohio Railroad, and incorporated the same year. Pop. 1920, 50,177; 1930, 75,572.

HUNTINGTON MILL, in ORE TREATMENT, a fine-grinding machine, operating by the centrifugal force of steel rollers revolving against the inner surface of a heavy steel ring.

HUNTINGTON PARK, a residential suburb 5 mi. from Los Angeles, situated in Los Angeles Co., southern California. It is served by the Union Pacific, Southern Pacific, Santa Fé and Los Angeles railroads and the Pacific Electric Railway. Huntington Park has various manufactures, including oil well equipment, washers and glassware. The retail trade in 1929 amounted to $11,797,077. The city has grown rapidly. Pop. 1920, 4,513; 1930, 24,591.

HUNTSVILLE, a city of the Tennessee Valley, and county seat of Madison Co., Ala., 18 mi. south of the state line, and 100 mi. north of Birmingham. The Nashville, Chattanooga, and St. Louis and the Southern railroads provide transportation facilities. The surrounding country has coal and clay deposits, extensive nurseries, and marble quarries. The city's factories include large cotton mills. In 1929 the retail trade amounted to $9,220,408. Normal, to the northeast, is the seat of the State Agricultural and Mechanical College for Negroes, founded in 1875. Big Spring, the Monte Sano health resort, and the Cumberland Plateau are features of interest. John Hunt of Virginia founded Huntsville in 1805; the city was chartered in 1844. Pop. 1920, 8,018; 1930, 11,554.

HUNTSVILLE, a city in eastern Texas, the county seat of Walker Co. It is situated 65 mi. north of Houston, and is served by the International Great Northern Railroad. The city is surrounded by a region producing cotton, live stock and various farm crops. Timber cutting is an important interest. Fuller's earth, gas and oil are valuable resources of the vicinity. Huntsville is the seat of the Sam Houston State Teachers' College and the state penitentiary. It was founded in 1830 and incorporated in 1843. Gen. Sam Houston's grave is here and his home is an interesting landmark. Pop. 1920, 4,689; 1930, 5,028.

HUNYADI, JOHN (JÁNOS) (c. 1387-1456), Hungarian soldier, was born about 1387. He saw active service in the Hussite War in 1420 and under his command the Turks were defeated at Semendria in 1441 and at Hermannstadt the next year. After the death of the Emperor Sigismund he became one of the five Magyar captains general, in 1446 was made Governor of Hungary and in appreciation of his services was created count. Hunyadi again defeated the Turkish Army in 1454 and in 1456 he was victorious in a naval engagement, forcing Mohammed II to return to Constantinople. He died in his camp Aug. 11, 1456.

HUON PINE (*Dacrydium Franklinii*), a lofty Tasmanian tree of the yew family much prized for its valuable timber. It grows from 80 to 100 ft. high, often attaining a girth of 20 ft., with slender drooping branches crowded with small bright green leaves. The light-yellow, wavy-grained aromatic wood, which is very tough, durable and easily worked, is much used in boat and ship building and also for carving.

HUPA, a California Indian tribe speaking an Athapascan dialect. Their villages formerly occupied the Trinity River Valley, from South Fork to its junction with the Klamath. Culturally, they are typical of the Northern California tribes. They lived in semi-subterranean slab houses, depended for food on hunting, fishing and acorn flour, and made beautiful twined baskets. The men were simply clothed in skin breechcloth and moccasins, while the women wore a skin skirt, over an apron, reaching to the knees. To this was added a deerskin robe when necessary. They practiced shamanism and had ceremonies to celebrate the new year and the first harvest.

HURD, NATHANIEL (1730-77), American engraver, was born at Boston, Mass., Feb. 13, 1730. One of his early copper engravings is a bookplate for Thomas Dering, dated 1749. He engraved on gold, silver, copper, brass and steel, and was considered the finest engraver in the colonies of his time. In 1762 he engraved a caricature portrait of Dr. Seth Hudson, a notorious character, and in 1764 a portrait of Reverend Joseph Sewall. Existing examples of his work include a Masonic notice, numerous bookplates, and the seal of Harvard University. He died at Boston, Dec. 17, 1777.

HURDLE RACING, a form of running races in which the contestant jumps over a number of obstacles placed at given intervals in the course. Hurdle racing is included in all college and amateur track meets and in the OLYMPIC GAMES. There are two standard hurdle races. In the high hurdles the distance is 120 yards. Ten hurdles 3 ft., 6 in. high are spaced 10 yards apart, with a 15-yard run from the start to the first hurdle and a similar distance from the last hurdle to the finish. High hurdles are usually hinged at the center so that if the runner touches one it falls without throwing him. The best high hurdlers take but three steps between hurdles, which requires perfect form acquired only by long training. The low hurdles are run at 220 yards over 10 hurdles set 20 yards apart, with a 20-yard run at the start and finish. These hurdles are 2 ft., 6 in. high, and the best low hurdlers take them in their stride.

HURON, a city in eastern South Dakota, the county seat of Beadle Co., situated on the James River, 90 mi. south of Aberdeen. Two railroads and bus lines afford transportation. There is an airport. Huron is the trade center of eastern South Dakota, a shipping point for the corn, live stock, poultry and dairy products of the James River Valley. The chief industries are meat-packing and machine shop work. The retail trade in 1929 amounted to $8,541,195. The city is the seat of Huron College. Huron was settled in 1880 and incorporated in 1883. Pop. 1920, 8,302; 1930, 10,946.

HURON, LAKE, one of the five Great Lakes in east central North America. It lies on the border line separating the United States and Canada, between 46° and 43° N. lat and 80° and 45° W. long. Michigan provides the western coast and the province of Ontario surrounds the other three sides. Lake Huron is the second largest of the Great Lakes with a water surface of 23,010 sq. mi., 9,110 of which come within United States territory. Its greatest length, which is from north to south, is 206 mi., width 101 mi., and mean depth 210 ft. The maximum depth is 750 ft. and the mean elevation above sea level 580.94 ft.

The coast line of the lake, measuring 1,165 mi., is very irregular, due to promontories and bays. Georgian Bay indents the Ontario coast, Saginaw Bay the Michigan side, and the existence of Grand Manitoulin Island to the north creates North Channel. Historic Mackinac Island lies just west of this feature. The lake drains an area of 72,420 sq. mi., 24,850 of which

lie within the border of the United States. Both lakes Superior and Michigan drain into Huron, the former through St. Mary's River and the latter through Mackinac Straits. Both of these inlets are channels by which the great cargoes from the mines, forest and farms of the west enter Lake Huron on their way to eastern cities and ocean ports. The outlet of the lake is by way of the St. Clair River, St. Clair Lake and Detroit River, which waterways have a combined length of 100 mi. and a fall of 8.51 ft. The cargoes passing through this connection in 1929 aggregated 110,719,845 tons, most of which came from ports on lakes Superior and Michigan, or from the east. Of the five lakes, Huron has the fewest and smallest harbors. Alpena, Port Huron and Bay City are the largest in point of population but Rockport, Mich., does the most shipping. In 1929 it cleared 1,807,371 tons of freight, 1,790,170 of which were limestone.

Lake Huron was first seen by white men in 1615 when Father Joseph LeCaron, a Franciscan monk, was sent by Champlain to do missionary work among the Huron Indians. It was the first of the lakes to be discovered.

HURRICANE, the name originally given to the extremely violent storms occurring in the Caribbean, but now extended to cover similar storms in other localities, except in the China Sea and the East Indies where they are called TYPHOONS. The strength of a hurricane is measured by 12, the largest number on the Beaufort scale of wind strength; its velocity may be anywhere from 75 to more than 100 miles per hour. A hurricane is a true cyclone, with the currents of air spiraling inward in a counterclockwise direction in the northern hemisphere, and usually accompanied by heavy rain and thunderstorm phenomena. It occurs chiefly in the tropics and most frequently during late summer.

HURST, FANNIE (1889-), American novelist, was born at Hamilton, O., Oct. 19, 1889. She graduated at Washington University, St. Louis, in 1909, and took special work in literature at Columbia in 1910-11. In 1915 she married Jacques S. Danielson of New York City. By working as a waitress, saleswoman and in other like capacities, she gathered material for her popular short stories and novels. Among her books are *Lummox, Mannequin, A President is Born, Appassionata* and *Five and Ten.* Her *Humoresque* and *Back Pay* were dramatized.

HURTADO DE MENDOZA, DIEGO (1503-75), Spanish diplomat, historian and poet, was born at Granada, in 1503. He distinguished himself in the Italian wars, and was sent as ambassador to Venice and the Pope. In his 65th year he participated in a brawl at the royal palace at Madrid, for which action he was exiled. From Granada, in the immediate neighborhood of the Morisco rising, he wrote the *Guerra de Granada,* an extremely frank account of the direction of the war, and of the conduct of various important personages, whom he evidently abhorred, which renders the book invaluable. Mendoza died at Madrid in 1575.

HU SHIH (1891-), Chinese philosopher and writer, was born of an old scholar family of Anhwei province. He is a graduate of Cornell (B.A. 1914) and Columbia (Ph.D. 1917). Even before he returned to China in 1917 he became prominent as an advocate of the use of the colloquial instead of the classical language for philosophical and literary purposes. His own writings in the colloquial language, both philosophical and literary, have won him a place as one of the outstanding leaders of modern liberal thought in China. He has been head of, and has served in various capacities with the National University in Peking, and has headed schools in Shanghai.

HUSKISSON, WILLIAM (1770-1830), English statesman and financier, was born at Birch Moreton, Worcestershire, Mar. 11, 1770, the son of William and Elizabeth Huskisson. At the age of 13 he went to live with an uncle in Paris where he had unusual opportunities to know the men and movements of that soul-stirring period.

Soon after his return to England he entered upon his political career, at first under the leadership of Pitt and afterward in close cooperation with Canning. By 1795 he was under-secretary for war and later was twice secretary to the treasury. For over 20 years he was colonial agent for Ceylon and from 1814 to 1823 was commissioner of woods and forests. Meanwhile, he had been elected to Parliament from Morpeth in 1796, from Liskeard in 1804 and from Chichester in 1812. He was one of the authors of the report of the bullion committee in 1810, and drew up the report of the committee on the corn laws in 1821.

Early in 1823 Huskisson became president of the board of trade with a seat in the cabinet later in the year. He was able during the brief years from 1823 to 1827 virtually to effect a commercial revolution, which Cabden later declared was more important than many political ones have been. In these changes he had the loyal support of Canning, whose eloquence helped to carry through the necessary legislation and to ward off the attacks of hostile critics.

The principal work of Huskisson was to simplify or abrogate the laws that were stifling trade, commerce and industry; to encourage shipping, while freeing it from unnecessary restrictions; to remove some of the prohibitions hampering the use of labor and machinery; to admit raw materials as freely as possible, to lower duties on manufactured goods and to establish reciprocity with other countries. Toward the colonies he showed a spirit of friendly cooperation that laid the foundations for the imperial policy of the next hundred years. To the corn laws he was frankly opposed though he realized the difficulties of doing away with them entirely in view of the powerful landed interests.

After the death of Canning in Aug. 1827, Huskisson accepted the colonial office with the leadership of the House of Commons, which he held during the brief Goderick ministry and then under the Duke of Wellington until the breach with him in May 1828. During the last two years of his life he took a promi-

nent part in parliamentary debates, supporting Catholic emancipation and moderate reform of the franchise. He was also deeply interested in questions of trade, particularly with India and China. In spite of failing health he felt it his duty to attend the opening of the Manchester and Liverpool Railway Sept. 15, 1830. There he fell and an engine ran over his leg inflicting injuries from which he died a few hours later. A. L. L.

HUSS, JOHN (1369-1415), celebrated Bohemian religious reformer, the son of well-to-do but humble Czech parents, was born at Husinetz, near Prachatitz, in Southern Bohemia, July 6, 1369. He was educated at the University of Prague, where, from 1396 to 1398, he lectured on the teachings of Wycliffe. He was appointed dean of philosophy in 1401, and the next year became rector of the university. His sermons in Czech, in the Bethlehem Chapel, Prague, attracted much attention by their hostility to German domination, their advocacy of the doctrines of Wycliffe, and their evident endeavor to reform the Catholic church from within. His public condemnation of the Bull of Pope John XXIII, in 1412, which called for a crusade against Lladislaus, king of Hungary, and his denunciation of the methods of preaching indulgences, caused him to be excommunicated by the Pope the next year. In 1414, he was summoned to appear before the Council of Constance, and though he traveled thence under a safe-conduct from the emperor Sigismund, he was arrested as a heretic and was burned at the stake, July 6, 1415. His followers, known as Hussites, soon afterwards formed a politico-religious party and involved the country in a civil war which lasted from 1419 to 1434.

HUSSITES, the followers of JOHN HUSS (1369-1415), the Bohemian reformer. Their movement was based upon protest against abuses in the Church, the discontent of the peasantry because a third of the land belonged to the clergy, and a nationalistic spirit of resentment of the Slavs towards the Germans. Two groups of Hussites developed: the moderates, called the Utraquists, who insisted upon receiving communion in both kinds, and the more radical Taborites, who rejected most Church ceremonials and all sacraments save baptism and communion. When news of the death of Huss reached Prague a strong protest against his execution was sent to the Council of Constance, Sept. 2, 1415. The town of Tabor was soon founded as a stronghold of the reformers. Fighting broke out in 1419 in which a part of Prague was destroyed and a pitched battle was won by the Hussites with John Zizka as their leader.

When Martin V proclaimed a crusade, 1420, for their destruction, and a large army of crusaders appeared before Prague, the Hussites formulated their demands in a document known as the Articles of Prague. As these were rejected the Hussites continued their struggle until most of the Bohemia fell into their hands, though victory was never complete because of internal discords growing out of theological disputes and personal ambitions. A war between the Utraquists and the Taborites led to the utter defeat of the latter, 1434, whereupon the more moderate party drew up the Compacts, a document embodying the principles contained in the Articles of Prague, which was formally accepted by Catholics and Hussites, 1436. The Utraquist thus became the Established Church of Bohemia until after the Battle of the White Mountain in 1620, when all non-Roman services were forbidden.

HUTCHINS, HARRY BURNS (1847-1930), American educator, was born, at Lisbon, N.H., on Apr. 8, 1847. He was educated at the University of Michigan. From 1872-76 he was assistant professor of history and rhetoric at that university and from 1884-87 Jay professor of law. From 1887-94 he held the chair of law at Cornell University. In 1895 he returned to the University of Michigan, serving as professor of law, dean of the law department, acting president, and finally, from 1910-20, as president, and from 1920-30 as president emeritus. Hutchins was a member of the international commission created by the treaty between the United States and Uruguay for the advancement of peace and was appointed by the Supreme Court to revise the Michigan Supreme Court Reports. He was consulting editor of *The American and English Encyclopaedia of Law and Procedure.* Hutchins died at Ann Arbor, Mich. on Jan. 26, 1930.

HUTCHINS, ROBERT MAYNARD (1899-), American educator, was born at Brooklyn, N.Y., Jan. 17, 1899. He entered Oberlin College in 1915, but in 1917 enlisted in the ambulance service of the United States, serving until 1919. From 1918-19 he was with the Italian army. He graduated from Yale University in 1921, taught English history at Lake Placid School for two years and returned to Yale as secretary of the university. In 1925 he graduated from Yale Law School and was made lecturer in the school in addition to his office of secretary. From 1927-28 he was acting dean and from 1928-29 dean of the law school. He organized, with the dean of the Yale Medical School, the Institute of Human Relations. In 1929 Hutchins was called to the University of Chicago as president.

HUTCHINSON, ANNE MARBURY (c. 1600-43), religious enthusiast, was born in Lincolnshire, England, about 1600. In 1634 she married William Hutchinson and in the same year emigrated to Boston, Mass., where she organized religious meetings opposed to the Puritan ministers and was soon involved in the so-called "Antinomian controversy." She was upheld by the great majority of the Boston church, as well as by Gov. Vane, John Cotton, and Rev. John Wheelwright, but in 1637 she was excommunicated and banished. She founded a colony in Rhode Island in 1638 and in 1642 moved to the Dutch Colony of New York where she and her whole family with the exception of one daughter were murdered by the Indians in 1643.

HUTCHINSON, ARTHUR STUART MENTETH (1879-), English novelist, was born in 1879 in Gorakpur, India, of English parentage. He studied medicine at St. Laurence College, Thanet, England,

but preferred a literary career. In 1912 he became editor of *The London Daily Graphic* and published his first book, *The Happy Warrior.* In 1921 Hutchinson's great success, *If Winter Comes,* was published. Among his other novels are *This Freedom,* 1922, *One Increasing Purpose,* 1925, and *The Book of Simon,* 1930.

HUTCHINSON, SIR JONATHAN (1828-1913), English surgeon and pathologist, was born July 23, 1828, at Selby, Yorkshire. He entered St. Bartholomew's hospital, became surgeon to the London Hospital in 1859, and professor of surgery at the Royal College of Surgeons in 1879. Hutchinson was an outstanding surgical pathologist. He is noted for his description of the notched, peg-shaped incisor teeth (Hutchinson's teeth) in congenital syphilis. His *Archives of Surgery* in ten volumes, written entirely by himself, constitutes a vast source of original observations on disease. He died in Haslemere, Surrey, on June 26, 1913. M. F.

HUTCHINSON, THOMAS (1711-80), American colonial governor, was born in Boston, Sept. 9, 1711. After graduating in 1727 from Harvard, he entered his father's mercantile business and took a prominent part in public affairs. He was instrumental in working out a stable financial structure for the colony and represented Massachusetts in the Albany Convention in 1754. In 1758 he became lieutenant-governor, in 1760 chief justice, and in 1771 governor of the colony. While in these offices the friction between England and the Colonies was increasing and Hutchinson made himself very unpopular by consistently supporting British policies, particularly defending the sovereignty of Parliament. In 1774 he was forcibly expelled from the colonies, and went to England to live. He wrote a *History of Massachusetts Bay,* a work now valuable for its historical authenticity. He died in London, June 3, 1780.

HUTCHINSON, a city in southern Kansas, the county seat of Reno Co., situated on the Arkansas River, 58 mi. northwest of Wichita. Bus lines, an interurban electric railway, three railroads and a municipal airport serve the city. Hutchinson is a shipping and market center for grain and livestock produced in the vicinity. The local industries include meat packing, flour milling, bag and straw board manufacture and salt refining. In 1929 the factory output reached a total value of $15,838,888; the retail trade amounted to $21,593,775. The city is built on large salt deposits. Oil and gas are found in the vicinity. Hutchinson was founded in 1871 and incorporated in 1872. Pop. 1920, 23,298; 1930, 27,085.

HUTTEN, ULRICH VON (1488-1523), German humanist, was born near Fulda, Apr. 21, 1488. In 1505 he fled from the monastery of Fulda where he had been placed by his family, and thereafter devoted himself to humanistic writings. He visited Italy several times, was for some years a friend of ERASMUS and wrote a number of the famous *Epistolae Virorum Obscurorum.* Later he joined Luther's party and turned his satirical pen against the Papacy, using the German language in his writings for the first time in 1520. Hutten died on Ufnau Island, Lake Zurich, Aug. 29, 1523.

HUTTON, JAMES (1726-97), Scotch geologist, was born at Edinburgh, June 3, 1726. His interest in science led him to abandon the law, and devote himself to the study of geology, chemistry, physics, meteorology, agriculture and allied subjects. In 1795 he published his *Theory of Earth, with Proofs and Illustrations,* demonstrating the rôle of running water in the formation of the landscape, how the repeated submergence of the land resulted in the deposition of new rocks, and that the action of the earth's interior heat formed igneous rocks and caused volcanic action. His greatest contribution lay in his insistence that present processes are the key to past occurrences. He died at Edinburgh, Mar. 26, 1797. *See also* GEOLOGY.

HUTTON, MAURICE (1856-), Canadian educator, was born in Manchester, England, in 1856. He was educated at Oxford, where he was a fellow of Merton College from 1879-86. In 1880 he became professor of classics at University College, Toronto, where he was made professor of Greek in 1887, and in 1901 principal. The latter office he held until 1928. He is the author of *The Greek Point of View,* 1925; *All the Rivers Run Into the Sea,* 1928, and articles on Herodotus, Thucydides and other classical subjects, in the *Transactions of the American Philological Association,* 1910, 1911, 1912.

HUXLEY, ALDOUS LEONARD (1894-), English writer, was born July 26, 1894, the son of Leonard, and the grandson of THOMAS HUXLEY. He was educated at Eton and at Balliol College, Oxford. He served on the staff of the *Athenaeum* in 1919-20, and later was dramatic critic for the *Westminster Gazette.* His writings include poems, essays, short stories and novels, and of all the intellectual, disillusioned Post-War generation of English writers Huxley is perhaps the foremost. His essays include *On the Margin,* 1923, *Along the Road,* 1925, *Proper Studies,* 1927, and *Music at Night,* 1931. He has written a notable travel book, *Jesting Pilate,* 1926. Among his best known volumes of short stories are *Little Mexican,* 1924, *Two or Three Graces,* 1926, and *Brief Candles,* 1931. His outstanding novels include *Crome Yellow,* 1921, *Antic Hay,* 1923, *Those Barren Leaves,* 1925, *Point Counter Point,* 1928, and *Brave New World,* 1932.

HUXLEY, THOMAS HENRY (1825-95), English naturalist, was born at Ealing, May 4, 1825. Graduating from the medical school of Charing Cross Hospital, London, in 1845, he was appointed a year later assistant surgeon on the H.M.S. Rattlesnake, for a surveying expedition in Australian waters. Here young Huxley studied many forms of marine life, and for four years collected, analyzed and wrote. The theory of germinal layers in the vertebrate embryo, still a basic zoölogical principle, was first set forth in his important publication *On the Anatomy and*

the Affinity of the Medusae. He returned from the cruise to find this work had established him as a leading biologist. In 1851 he published *Philosophical Transactions,* and was elected a Fellow of the Royal Society. Six years later Huxley took the chair of natural history and paleontology at the Royal School of Mines. Thereafter, honors crowded upon him and he constantly enlarged the range of his brilliant achievements, as scientist, lecturer, writer, sociologist and educator. With some qualifications, he supported DARWIN's theories as set forth in *The Origin of Species,* and on an American trip in 1876 he spoke on evolution among other scientific subjects. Huxley drew to him the younger scientists and proved himself as great a teacher as he was a biologist. His researches covered most departments of biology, and his more important books, having passed through many editions, are still authoritative to-day. Among them are the *Elementary Physiology,* 1861, and the *Elements of Biology,* written with Dr. H. N. Martin, 1875. His essays, lectures, scientific memoirs and other papers have been published since his death. Huxley died at Eastbourne, England, June 29, 1895.

HUYGENS (HUYGENIUS), CHRISTIAN (1629-95), Dutch physicist, son of the famous Dutch poet, was born at The Hague, Apr. 14, 1629. He improved the telescope and championed the then neglected wave theory of light, particularly in his explanation of the double image transparency of Iceland spar. In 1655 he discovered the large satellite and rings of Saturn. Turning his attention to the pendulum he worked out the laws of centrifugal force, inventing in 1656 the pendulum clock. He died at The Hague, June 8, 1695.

HUYGENS, SIR CONSTANTIJN (1596-1687), Dutch poet, man of letters and statesman, was born at The Hague, Sept. 4, 1596. His father was of considerable political importance, and the young Huygens received an excellent education. He entered the diplomatic service in 1619, and was chosen private secretary to the Prince of Orange in 1625. Five years later Huygens entered the privy council and remained politically active to the end of his long career. Remarkably versatile, he was an accomplished lute-player and painter, as well as an athlete and a famous poet; he wrote poetry in Italian, French, Latin and Dutch. Among his other works are several comedies, memoirs, essays on music and many state-papers. Huygens died at The Hague, Mar. 28, 1687.

HUYSMANS, CORNELIS (1648-1727), Flemish landscape painter, was born at Antwerp in 1648. He was influenced by Poussin and Rubens whose styles he combined in woodland scenes which are highly colored but often somewhat monotonous. He also executed large religious works. The Metropolitan Museum, New York, has his *Italian Landscape* and *Landscape with Figures.* Huysmans died at Malines, June 1, 1727.

HUYSMANS, JORIS KARL (1848-1907), French novelist, was born in Paris, Feb. 5, 1848. He was originally one of the chief followers of Emile Zola's naturalistic school of the novel, and *Marthe, Les Soeurs Vatard,* and *En ménage,* 1881, are all realistic to the last degree. Later he became absorbed in decadence and "art for art's sake," writing *A Rebours* and *Là Bas.* In 1892 Huysmans experienced a religious conversion and thenceforth his novels became the outward sign of his ardent Catholicism, his best known work of the latter period being *La Cathédrale,* 1898, a notable volume on Chartres Cathedral. He died on May 13, 1907.

HWANG HO, or Yellow River, the second largest river in China. The river has its source in the northern slopes of the Himalayas, at approximately 34° north latitude and 97° degrees east longitude, at an altitude of between 14,000 and 15,000 ft. After forming a large "S" the river enters Kansu Province, and in the next 150 mi. it drops from 8,000 ft. to 5,200 ft. at the city of Lanchow. By this time it has met a number of tributaries and has become sufficiently large for Lanchow to be the head of navigation by scows and rafts. From Lanchow the river turns northward, then abruptly east, then abruptly south along the western side of Shansi Province to Tungkwan where Shansi, Shensi and Honan Provinces meet. Here it turns east again, and enters the plain country. From Lanchow to Tungkwan by river is 1,200 mi., with a fall of 4,200 ft., 2,000 ft. of this fall coming in the 375 mi. along Shansi province. From Tungkwan the river runs almost due east to a point a little north of Keifeng in Honan Province, and then turns northeast to empty into the Gulf of Peichihli north of the Shantung Peninsula. The distance from Tungkwan to the sea is roughly 700 mi., with a fall of 1,000 ft. The total length of the river is approximately 2,500 mi. or about that of the Mississippi River. The Hwang Ho basin is about 600,000 sq. mi., with a population of roughly 100,000,000 people.

In its upper reaches, the Hwang Ho picks up a heavy load of SILT as it passes through the LOESS country of Kansu province. It begins to deposit this soon after it flows out onto the Honan plain, east of Tungkwan where its current is slow because of the slight fall from this point to the sea. These deposits build up the bed of the river. In the summer, partly from heavy rains during the rainy season and partly from the melting snows at the source, the volume of the river increases considerably. To prevent floods, dykes have been built along most of the course from Tungkwan to the sea. As the bottom of the river between these dykes is built up by silt deposits, it becomes necessary to build the dykes higher. As a consequence, for considerable stretches across the plain the bottom of the river bed is higher, sometimes by as much as 15 or 20 ft., than the surrounding plain. When the dykes do break, therefore, the flood river waters spread over large areas of the countryside. For this reason, the Hwang Ho frequently is referred to as "China's Sorrow." The river several times has shifted its mouth into the sea from one side of the Shantung hills to

the other, causing very widespread destruction in the process. The last of these shifts occurred in 1854, when the mouth moved from the south of Shantung to the north.

Considerable transportation takes place on the river, shallow draft scows and rafts, frequently made of inflated animal skins, being used from Lanchow eastward and small junks of a more substantial type serving from Tungkwang down into Honan. G. C.

HYACINTH (*Hyacinthus orientalis*), a widely popular pot and early garden flower. It is a bulbous perennial of the lily family, originally a native of Greece and Asia Minor. In the wild state the hyacinth bears a puny cluster of inconspicuous washy blue flowers, but by centuries of cultivation it has been developed into a most attractive and showy ornamental. The plant rises from a large globular bulb, bearing long narrow root leaves and a short-stalked dense flower cluster often 6 to 9 in. long and 2 to 3 in. in diameter. The flowers, which exhibit marked variation in size and form, are frequently double and occur in a wide range of color from crimson and scarlet to pink, blue, yellow and white. Hyacinth bulbs are grown commercially on a large scale, especially in Holland.

HYACINTH, in mineralogy. *See* ZIRCON.

HYACINTH BEAN. *See* LABLAB.

HYACINTHUS, in classical mythology, a youth of great beauty, son of Amyclas, King of Sparta, and DIOMED. He was loved by APOLLO and ZEPHYRUS and was killed by a blow in the head from a discus while playing quoits with them. From the blood which flowed sprang the flower called hyacinth.

HYADES, a V-shaped group of stars in the constellation TAURUS, 130 light years distant.

HYATT, ANNA VAUGHN (1876-), American sculptor, was born at Cambridge, Mass., Mar. 10, 1876. She studied at the Art Students' League, New York, and was a pupil of Hermon MacNeil and GUTZON BORGLUM. She soon won recognition for her work, which led to her being made a member of the National Academy and a Chevalier of the Legion of Honor (France). In 1923 she married ARCHER M. HUNTINGTON. Among the sculptor's many awards, was the Grand Cross of Alfonso XII of Spain, received in 1929. Her works include small bronzes in the Metropolitan, Carnegie, San Francisco, San Diego, Luxemburg and Edinburgh museums; lions in Dayton, O.; memorial piece at Lancaster, N.H.; *Joan of Arc,* in New York, Gloucester, Mass., San Francisco, and Bloise, France; *El Cid,* New York, and Seville, Spain; *Diana,* New Orleans, La., Austin, Tex., and Cambridge, Mass.; and flagpoles in New York City.

HYBLA, the name of three ancient Greek cities in Sicily, one of which, probably Hybla Major on the southern slope of Mt. Etna, was the town famed in classical literature for its honey. Hybla Minor, afterwards Megara, was on the eastern coast of the island north of Syracuse. Hybla Heraea was on the southern coast between Syracuse and Agrigentum, the modern Girgenti.

HYBRIDISM, the theory and practise of sexual crossing of individuals (strictly the union of their germ cells) belonging to dissimilar species, varieties, races or strains. Half a century ago hybridism was differentiated from mongrelism as indicating a greater degree of diversity in the blood lines crossed. The term hybrid was applied to the results of species crossing; the term mongrel to the results of variety crossing. With the spread of Mendelism and a more precise knowledge of the nature of the basis of genetic differences the term hybridism may well be extended to all cases in which the strains crossed differ by one or more genetic units or genes. Hybrid progeny are characterized by this, that in at least one pair of chromosomes one or more genes are dissimilar so that the individual is said to be heterozygous in respect to such genes or the qualities which depend primarily upon them. From this point of view the offspring of a brown-eyed Italian man and a blue-eyed Irish girl may be said to exhibit hybridism generally and in respect to eye color specifically. In the example given the offspring would probably be heterozygous in respect to other traits also, such as hair color, form of face and features, even bodily proportions and possibly temperament.

At the further extreme are the cases where the individuals crossed belong to recognized distinct species. Such hybridism is not so common, though the examples of effective hybridism between purely distinct species have become so numerous, owing to the results of genetical work in the last third of a century, that it would be impracticable to catalogue them. Especially among plants distinct species, genera and even families have been hybridized with the production of fertile offspring. In the case of animals crosses can be made between different genera, as for example, in echinoderms among the invertebrates and in pigeon-like birds among vertebrates. The offspring are, however, usually, though not invariably, sterile. The reason for the sterility is sometimes found in the dissimilarity of the chromosome complexes in the species crossed, which does not enable the chromosomes to make physiologically appropriate unions. Among well-known hybrids are those between bisons and European cattle, which are fertile, and between the horse and the ass, which are generally, though probably not universally, sterile. C. B. D.

HYDATID DISEASE. *See* PARASITIC DISEASES.

HYDE, DOUGLAS (1860-), Irish poet and scholar, was born at Frenchpark, Co. Roscommon, Jan. 17, 1860. He was educated at Trinity College, Dublin, where he made a special study of Gaelic songs and folklore, and afterwards was chiefly occupied with researches in Irish literature. In 1893, to preserve the Irish language, he founded and was president of the Gaelic League. He was made chairman of the Folklore Institute of Ireland, in 1930. Among Hyde's works are *A Literary History of Ireland,* 1899, *Love Songs of Connacht,* 1894, *Raftery's Irish Songs* and a translation from the Gaelic of a *History of Charlemagne,* 1919.

HYDE PARK, the largest and most fashionable public park in London, covering 364 acres between Green Park and Kensington Gardens. Named after Hyde Manor, an ancient possession of Westminster Abbey, it became a Crown land during the Reformation, and was enclosed by Henry VIII and used as a deer park. Charles I, making it a fashionable resort, opened it to the public in 1635. The park presents a rural appearance and is favored by the elect of London society. Nine carriage entrances lead in to the park, and of these Hyde Park Corner is the most notable, a triple gateway designed by Decimus Burton, 1828, with carved reliefs copied after those of the Parthenon frieze. Of special interest in the park itself are the Serpentine, an artificial lake which is crossed by Rennie's Bridge; the famous bridle path, Rotten Row; the Dell, a charming subtropical garden; the Byron statue; the colossal "Achilles statue" by Sir R. Westmacott, 1822, honoring the Duke of Wellington; and the Bird Sanctuary, a memorial to W. H. HUDSON. Outside Cumberland Gate is the Marble Arch—a noted rendezvous for open-air orators of every description—which was moved in 1851 from in front of BUCKINGHAM PALACE to its present site (erected originally by John Nash, 1822). Hyde Park was the scene of the Great London Exhibition in 1851 (*see* CRYSTAL PALACE).

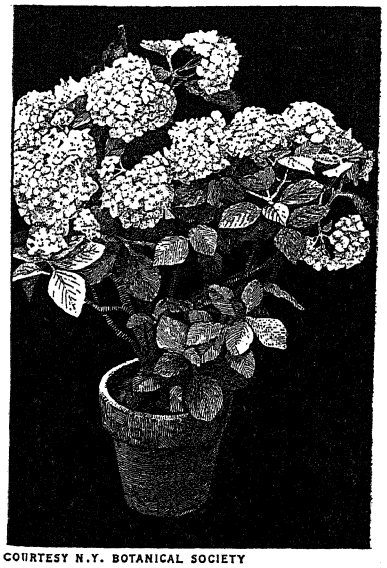
HYDERABAD, a capital city and the largest native state in India, in the region called the DECCAN. The state is naturally divided into two major sections, the Telingana and the Marathwara, and contains both flat and mountainous regions. Many rivers, including the Godavari, Wardha, Kistna, Manjira, Dudna and Pramhita, traverse the country but they are of little importance for communication. There are three railway lines: the Bombay-Madras, the Madras and Southern Maharatta, and the Hydarabad-Godavari. Of minerals the state has iron, copper, gold, diamonds and some coal. Grain, especially millet, and wheat, are the chief crops, although fruits, cotton and tobacco are important. Exports include cotton, grains, timber, hides, coarse woolen cloth and oilseeds. In 1919 an executive council under a president was established. At the capital there is a British resident. Area 86,698 sq. mi. Pop. 1921, 12,471,770.

Hyderabad, the capital of Hyderabad state, situated in the southern part of the state on the Musi River, was founded in 1589. It was first known as Bhagnagar. A very important trading center, Hyderabad contains the Mecca Mosque, palaces of the various Nizams, the handsome British Residency, a college and university, and several colorful bazaars. The city was badly damaged by a flood in 1908. Pop. 1931, city, 377,006; state, 14,395,493.

HYDRA, in Greek mythology, offspring of Typhon and Echidna, was a monster with many heads. One of the 12 labors of HERCULES was to slay this monster, which he did with the help of Iolaus. Hercules dipped his arrows in the blood of the Hydra, which was poison, and thus was certain that wounds made by these arrows would be fatal.

HYDRA (gen. *Hydrae*), the watersnake, a very long constellation, its head beginning near Cancer while its tail stretches as far as Libra. Except for Alpha Hydrae (Alphard, the lonely one) it contains no bright stars. Epsilon Hydrae, a fourth magnitude star, is a double composed of two stars, one 70, the other 18 times brighter than the sun, revolving in 15 years at a distance of 110 million miles from each other. *See* STAR: *map.*

HYDRANGEA, a genus of handsome woody plants of the saxifrage family, several of which are cultivated for ornament. There are about 30 species, natives of Asia and the New World, 4 of which occur in the United States. They are mostly erect shrubs bearing simple opposite leaves and showy clusters of pink, white or blue flowers. The garden hydrangea



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GARDEN HYDRANGEA
Hydrangea macrophylla var. *Hortensia*

(*H. macrophylla*), a stiff late-flowering shrub, native to eastern Asia and grown indoors for winter blooming, is widely planted in the open in mild climates. As in various other species, the flowers, usually white or pink, become blue when certain salts of aluminum and iron are present in the soil. The wild hydrangea (*H. arborescens*) of the eastern United States, with globular clusters of white flowers, is often cultivated, as is also the oak-leaved hydrangea (*H. quercifolia*), found in the South.

HYDRARGYRUM, the Latin and Greek name for mercury or its derivatives; frequently used by physicians in writing prescriptions for mercury compounds. From this is derived the symbol Hg, for MERCURY.

HYDRATES, the name given in chemistry to a class of complex substances which contain one or more molecules of water in their molecule, and where the water is too loosely attached to call it a chemical compound. Very often the joining of molecules of various salts with those of water gives rise

to crystalline bodies, and it almost appears as if the presence of water were essential for the formation of crystals. The alums, which consist of mixed sulphates of the alkalis, aluminum, iron or similar metals, and crystallize in octahedra—washing soda, borax, and copper sulphate, or "blue vitriol"—are among the more familiar hydrates. Sometimes the name hydrate is also used for hydroxide, such as potassium hydrate for caustic potash, but this term is now seldom used.

HYDRATION, the combination of a substance with water or with the elements of water. The product so obtained is called a hydrate. The latter term is also occasionally but less properly applied to Hydroxides, as calcium hydrate. Among the most familiar hydrates are the various hydrated salts. These are often designated by appropriate prefixes to indicate the number of molecules of water entering into the compound. Thus we have the mono-, tri-, and penta-hydrates of copper sulphate: $CuSO_4.H_2O$, $CuSO_4.3H_2O$, $CuSO_4.5H_2O$. O. R.

HYDRAULIC BRAKES. *See* Brakes.

HYDRAULIC ENGINEERING, that branch of civil engineering which applies the science of hydrology and Hydraulics to the investigation, design, construction and operation of works and machinery for collecting, storing, carrying and using water. The principal works with which it deals are those for Water Power, Water Supply, water purification, Sewerage, Sewage Disposal, flood prevention and control, Irrigation, Drainage, Navigable Waterways, Harbors, Ports and Coast Protection.

Among the structures which make up such works are Dams, Retaining Walls, Wells, Canals, navigation Locks, Docks, Piers, Drydocks, Sea Walls, Shafts, Tunnels, Flumes, Pipe Lines, Reservoirs, tanks, water power stations and water pumping stations. Since the design of these involves many structural problems not elsewhere encountered, the practice of hydraulic engineering has come to include their structural as well as their hydraulic design. The theory of earth pressures and the properties of earth and other granular materials also enter prominently into many problems of hydraulic engineering.

F. K.

HYDRAULIC LABORATORY, a place equipped for the study of the physical laws governing the motion of water, and for experimental research into actual flow and the laws of flow in hydraulic structures.

Many colleges have hydraulic laboratories, some indoors and some outdoors, to take advantage of flowing streams and natural terrain for experimental and model work. Problems of hydraulic power and river flow, such as flood control, improvement of rivers and harbors, erosion, transportation, deposition of sediments, are advantageously studied in both the indoor and outdoor laboratories, with the aid of small scale models and the application of the laws of hydraulic similitude.

The United States Government has completed the building of a National Hydraulic Laboratory, on the property of the Bureau of Standards in Washington, D.C. This Laboratory will be operated under the direction of the Bureau. An outdoor hydraulic laboratory, for the purpose of river experimental work, and operated under the jurisdiction of the United States War Department, is located at Vicksburg, Miss.

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HYDRAULIC LIME. *See* Cement.

HYDRAULIC MACHINERY, those assemblages of moving mechanical parts which serve: To convert Water Power into other forms of power; To elevate and convey water by the use of power, or Which use water as a medium for transmitting or absorbing power. Those which serve the first purpose are called hydraulic Prime Movers or motors (*see* Turbines, Water) and those serving the second purpose, hydraulic Pumps. The principal hydraulic prime mover is the water turbine. Other forms are overshot, undershot and breast water wheels; the current or paddle wheel; hydraulic engines of reciprocating, Brotherhood, and Schmidt oscillating types; and the hydraulic Air Compressor. Many hydraulic prime movers, if slightly modified, are capable of being reversed and used as hydraulic pumps. Thus the overshot waterwheel becomes the chain and bucket pump; the breast wheel becomes the scoop wheel; the turbine becomes the centrifugal pump; the reciprocating engine becomes the reciprocating pump; and the hydraulic air compressor becomes the Air Lift pump. In addition there are screw pumps, jet pumps, rotary pumps and Hydraulic Rams.

Machinery using water as a medium for transmitting power includes lifts and hoists, cranes, jacks, presses, riveters and hydraulically operated Brakes. Hydraulic Dynamometers and hydraulic brakes proper use water to absorb energy in the form of heat.

F. K.

BIBLIOGRAPHY.—A. H. Gibson, *Hydraulics and Its Applications,* 1931.

HYDRAULIC MEASUREMENT. The accepted unit of volume for accumulated water is the acre-foot which is equal to 43,560 cu. ft. The unit for rate of flow of water is the cu.-ft.-per-second. Rivers and large canals are divided into vertical strips and the velocity, v, in each determined with a current meter or floats. Within a strip, $q = av$ where a is sectional area and q the volume of flow. For the whole channel, the total flow, Q, is the summation of the local q's. For small flows most methods employ the same general principle; viz., the channel flow is passed through a weir-notch, orifice, throat or other constriction of known shape and dimensions. The area, A, is known for each particular depth. The constriction increases velocity, V, at the expense of surface elevation, this surface drop being the head, h. The falling-body law, modified by hydraulic-loss conditions in the device, gives $V = C\sqrt{2gh}$, where $g = 32.2$. and C is a constant determined by research. Thus $Q = Av = Ac\sqrt{2gh}$. *See also* Irrigation.

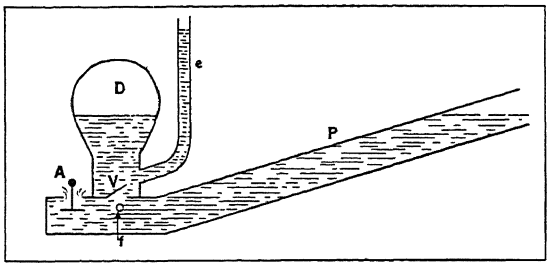
F. C. S.

HYDRAULIC POWER TRANSMISSION. *See* POWER TRANSMISSION, HYDRAULIC.

HYDRAULIC PRESS, a pressing machine in which the power is applied by liquid pressure, or hydraulically. Hydraulic presses are largely used where a slow, steady pressure is desired, as in forcing car wheels on their axles, or in FORGINGS where a large body of heated metal must flow into shapes differing widely from the original bar. Hydraulic presses are also used in bending or punching large sheets of steel and in forming plastic materials in Dies, and in baling cotton and other materials. The question of speed often militates against them and crank or toggle presses are now widely used both in punching and forming operations. *See also* PRESSES AND PRESSWORK.

F. H. C.

HYDRAULIC RAM, a device for raising a small quantity of water to a considerable height by utilizing a small fall in a stream. The water is conducted to the ram through a straight, smooth, inclined pipe, *P,* (see figure) offering little resistance to the flow. At *A,* a valve opens downward through which the water



HYDRAULIC RAM

at first escapes; but as the speed of the water increases, the valve is closed by pressure. This sudden stopping of the stream causes a great pressure at the end of the pipe in consequence of the forward momentum of the stream; under this pressure the valve, *V,* opens upward and water is forced into pipe, *e,* and the dome, *D,* slightly compressing the air in *D.* When the momentum of the water is spent, the reaction closes *V* and opens *A.* Water again flows out at *A* with increasing velocity until it is closed, and water is again driven through *V* by the hammer-like blow of the column of water in the pipe, *P.* This cycle of operation continues indefinitely, water being gradually forced up the pipe, *e,* until it may reach many times the height through which the stream falls. The air chamber, *D,* is essential as it furnishes an elastic cushion with but little inertia, enabling the valve, *V,* to respond instantly. At *f* there is a small opening where air is drawn in, to maintain the supply in the dome.

If the hydraulic ram were 100% efficient, it would raise one-tenth of the water flowing into it ten times as high as the original fall, or half the water twice as high. In practice, however, the efficiency of a good ram is seldom more than 50%. *See also* HYDRODYNAMICS.

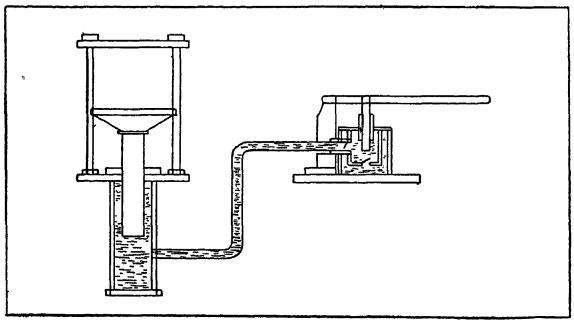
E. J. M.

HYDRAULICS, the science of fluids; and of bodies in, or surrounding and retaining fluids; the branch treating of fluids at rest is called *hydrostatics* and that dealing with fluids in motion, *hydrodynamics.* Fluids are of two classes, *liquids* and *gases.* Liquids are but slightly compressible while gases are very compressible. This important property of elasticity follows widely different laws in the cases of liquids and gases. Liquids obey the law that change in volume is directly proportional to the change in pressure producing it but is independent of the total pressure, whereas gases follow BOYLE'S LAW which is that change in volume is not only directly proportional to change in pressure but also inversely proportional to the square of the total pressure.

The underlying principle of hydrostatics is PASCAL'S THEOREM which states that a body of fluid at rest transmits pressure with equal intensity in every direction. From it follows the famous ARCHIMEDES' PRINCIPLE that a solid body submerged in a fluid is acted upon by an upward force equal to the weight of fluid displaced. BERNOULLI'S THEOREM, a general principle of great importance in hydrodynamics, is based on Newton's famous laws of motion and the laws of elasticity of fluids. Its common form establishes the relation between the values of velocity and pressure at one section of a stationary conduit, through which is flowing a steady stream of fluid, and the corresponding values at any other section of the same conduit. Its most general form applies to varying flow through a moving conduit. The laws of fluid friction are also important, their best known expression being Kutter's formula.

F. K.

The chief physical properties of a fluid are DENSITY, VISCOSITY and compressibility. The density of fresh water for all practical purposes may be taken as one gram per cu. cm. The viscosity varies with temperature, and the coefficient of viscosity, μ, is given by the expression $\mu = \frac{Fz}{v}$, where F is the force of drag in DYNES per sq. cm. on a flat surface which is traveling



HYDRAULIC PRESS

Force acting on large piston at left is greater than that impressed on small piston at right

with a velocity, v, relative to a similar surface z centimeters distant. In other words, the coefficient of viscosity is the force of drag per square centimeter between two layers of a fluid one centimeter apart when

the relative velocity is one centimeter per second. Water is almost incompressible and is so regarded for all practical calculations.

The hydraulic press shown here is an example of the application of Pascal's Law. A large cylinder is fitted with a piston of area, *A*, which carries the load. This cylinder is connected by a small pipe to a force pump with a small piston of area, *a*, which forces water into the cylinder of the press. Neglecting friction, a force, *f*, applied to the piston of the force pump will produce a force, *F*, on the press piston. By Pascal's Law, $F = f\frac{A}{a}$. If *f* is applied at the end of a lever as shown in the figure, the resulting force, *F*, will be correspondingly increased. E. J. M.

BIBLIOGRAPHY.—A. H. Gibson, *Hydraulics and Its Applications*, 1931.

HYDRAZINE, a colorless liquid, chemical formula N_2H_4 or $H_2N.NH_2$, slightly heavier than water. It is very poisonous and a powerful reducing agent when in aqueous solution. It boils at 113.5° C. and solidifies to colorless crystals at 0° C. It may be prepared by heating triazo-acetic acid with water.

HYDRAZOIC ACID, a colorless liquid (N_3H) having a penetrating odor, boiling at 30° C. and having the properties of a "weak" acid. It is extremely explosive, as are also its salts, the azides. Lead azide (PbN_6) is employed in military service. Hydrazoic acid may be prepared by adding ammonia to diazobenzene perbromide.

HYDRAZONES, dyestuffs produced by the action of hydrazine, $H_2N{\cdot}NH_2$, and especially its aromatic derivatives with an aldehyde or a ketone. Of these dyes, tartrazine, which is a brilliant yellow-green, has the greatest commercial importance, since it is a very "fast" dye.

HYDROCARBONS, organic substances which contain only hydrogen and carbon, and are broadly divided into Aliphatic (or open-chain) Compounds, and Homocyclic (or closed-chain) Compounds, which belong almost exclusively to the Aromatic Compounds. Among the former three different series are distinguished, viz., (1) the saturated paraffin series, in which each carbon atom has as many hydrogen atoms attached to it as possible; (2) the unsaturated Olefine Compounds, which contain two hydrogen atoms less than the corresponding paraffins, and (3) the still more unsaturated Acetylenes; the homocyclic hydrocarbons comprise chiefly the unsaturated substances benzene, naphthalene, anthracene, and phenanthrene and their derivatives.

All hydrocarbons are colorless substances; the simpler members gaseous, the more complex liquids or solids; all of them are combustible, but on the whole are characterized by a lack of chemical activity, most pronounced for the paraffins, and least for the acetylenes. In nature they occur in natural gases, as petroleum, in the secretions of certain trees, while the aromatic members are liberated by the destructive distillation of coal. *See also* Carbon Compounds.

W. J. L.

HYDROCELE, an accumulation of serous fluid in the neighborhood of the testis, and generally in one side of the scrotal sac. The testis develops in the back of the abdomen and migrates into its position late in fetal life, carrying with it a pouch of the Peritoneum. Normally, this pouch constricts at the abdomen, leaving a closed sac alongside the testis. The most usual type of hydrocele is a distension of this sac, which may or may not have been properly separated from the abdominal cavity.

The condition is evident as a smooth, tense, painless swelling of one side of the scrotum. Treatment consists of tapping to remove the fluid, of the injection of substances calculated to obliterate the cavity, or of operative destruction of the sac.

The term hydrocele is also used to designate a distension with fluid of certain accessory tubules connected with the testis or ovary but which are functionless after birth. W. J. S. K.

HYDROCEPHALUS, the accumulation of fluid within the skull. In one type known as hydrocephalus externus the fluid is between the brain and the skull. In hydrocephalus internus the fluid is within the brain cavities known as the ventricles. Hydrocephalus may be present at birth and obstruct labor. The cause of this type is unknown.

In this disorder the skull is enlarged, while the face is of normal size. There may be such symptoms as convulsions, increased action of the reflexes and various degrees of mental deficiency. Death occurs usually within 3 or 4 years.

Hydrocephalus may occur later on in life as the result of tumors, following meningitis or inflammation of the lining membrane of the brain. Numerous operations for treating hydrocephalus have been tried, but none has been found satisfactory. *See also* Neurosurgery. W. I. F.

HYDROCHLORIC ACID or **MURIATIC ACID,** an acid, with the formula HCl, the anhydride of which is a colorless gas having a critical temperature and pressure of 44 atmospheres at 20° C. It is ordinarily found in commerce in the form of an aqueous solution of the gas in water in strengths varying from 13.4° Be. (20.25% HCl by weight), which is the constant-boiling strength at 760 mm., to 24° Be. (39% HCl by weight), which represents the highest practical concentration for handling under ordinary conditions. The commercial grades of 18° Be. (27.9%), 20° Be. (31.4%) and 22° Be. (35.2%) are usually amber colored, due to the presence of small amounts of iron impurity in solution. The aqueous solutions are strongly acidic in character, being classed among the strong mineral acids.

Manufacture. Two main processes are used in making hydrochloric acid as a primary product, as follows: (A) Decomposing common salt (NaCl) with the molecular proportions of sulphuric acid (H_2SO_4) to yield hydrochloric acid (HCl) and crude sodium sulphate or so-called "salt cake" (Na_2SO_4); and (B) burning hydrogen and chlorine gases in combining proportions to yield hydrochloric acid gas.

A. *Decomposition of Sodium Chloride with Sulphuric Acid.* In carrying out the process (A) which uses common salt and sulphuric acid as crude materials several different types of equipment are used, thus:

(1) *Deacon or Pot and Furnace Type of Installation.* This consists of a direct-heated, shallow, circular cast-iron pan with brick cover in which the reaction is started and an adjacent muffle or calcining hearth in which the reaction is completed. The HCl gases evolved from both pot and furnace are conducted through earthenware flues to an earthenware condensing and absorbing system. Capacity of standard installation, 8 charges of 1,600-1,800 lbs. of salt and equivalent sulphuric acid per 24 hours.

(2) *Single Step Mechanical Types.* (*a*) Manheim or stirred cast-iron pan and cover into which the salt and sulphuric acid are fed continuously and from which HCl gas and finished salt cake are discharged continuously. The common standard condensing system for absorption and condensation is used to collect the HCl. Capacity of standard installation, 8 to 10 tons of salt per 24 hours. Fire gases kept separate from the HCl gases.

(*b*) Mactear or direct fired type. This is similar in principle to the Manheim, but the entire hearth revolves, mixing being done by small rotating plows working through arch of furnace. Coke firing is used, the fire gases coming into direct contact with the charge mixing with the HCl and passing to the condensing system.

(*c*) Laury or rotating-cylinder type. This is a horizontal brick-lined steel cylinder into which salt and bisulphate of soda are fed continuously, countercurrent to the flow of fire gases which come into direct contact with the charge and pass to the condensing system along with the HCl evolved.

B. *Electrolytic Process, Combining Hydrogen and Chlorine.* In the electrolytic process, HCl is made by burning the combining proportions of hydrogen and chlorine in a silica or quartz tube burner, the gases of combustion, which are HCl mixed with a small quantity of air, being cooled through silica-ware pipes and absorbed in any of the standard absorption systems. These installations are usually quite compact and yield a very good quality of HCl of any desired strength up to 24° Be.

Grades and Uses. Chemically pure HCl is made from commercial grade, treated with purifying reagents and followed by redistillation and condensation. The simplest way of accomplishing this redistillation is by passing an alternating electric current through the treated crude acid in a specially designed retort and continuously distilling and condensing strong acid in glassware condensers. This is usually the highest strength of aqueous hydrochloric acid produced, testing above 24° Be. or 38— 39.0% HCl.

Commercial hydrochloric acid is used in a number of the essential industries such as steel, chemical, textile, gelatin, sugar, leather, automotive—in fact, it will probably be found to be used in some major or minor capacity in almost every major industry. The chemically pure grades are utilized chiefly in connection with chemical analyses, food products, etc.

Hydrochloric acid is the acid normally present in the gastric juice and is necessary for the digestive action of pepsin on protein-containing foods. In medicine it is administered orally for treatment of diseases of the stomach particularly characterized by deficiency of acid and is also of service in intestinal putrefaction. E. A. T.

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HYDROCYANIC ACID, a weak acid (HCN), also called prussic acid and hydrogen cyanide. The pure anhydrous acid is colorless, very volatile and has a strong penetrating odor. Its vapor burns freely in air. The acid may be prepared by adding concentrated solution of sodium cyanide to sulphuric acid. It forms an ionizing solvent. Hydrocyanic acid is one of the most deadly poisons known, causing paralysis of the heart, respiratory center, and the vasomotor center in the medulla.

HYDRODYNAMICS, the science which deals with fluids in motion. It should be distinguished from HYDROSTATICS, which deals with the equilibrium of fluids at rest. *See also* HYDRAULICS; FLOW METERS; FLOW OF FLUIDS; HYDROMECHANICS.

HYDRO-ELECTRIC POWER, electric power delivered to transmission systems from generators driven by hydraulic turbines. *See* TURBINES, WATER. In 1930 the output of electricity generated by water power, in this country, aggregated 31,000 million kilowatt-hours. *See also* ELECTRIC GENERATOR; POWER TRANSMISSION, ELECTRICAL; ELECTRICITY SUPPLY.

HYDROFLUORIC ACID, a very active gaseous acid, having the formula HF, and prepared from calcium fluoride and sulphuric acid. It is used for etching glass and enamel, and for coagulating latex. It dissolves silica so must be kept in wax containers, furthermore it is a very poisonous acid.

HYDROGEN, a highly inflammable, colorless and odorless gas, having the symbol H, atomic weight 1.008, specific gravity 0.06948 (air = 1). It liquefies at —259°C., boils at —252.7° C., and has a molecular weight of 2.016. It is slightly soluble in water and is made from water by various processes such as: from steam by alternate interaction of iron with steam and of iron oxide with water gas; from steam and water gas by continuous interaction in the presence of a catalyst; from water gas by a process of liquefaction involving the removal of carbon monoxide; by employing carbon or iron and water under pressure; by decomposition with alkali metals; by aqueous decomposition of hydrides; by employing metallic alloys of metals which react with water; from electrolysis of alkalis and acids in aqueous solutions; from hydrocarbons by thermal decomposition, interaction with steam or interaction with carbon dioxide; and from miscellaneous sources which give by-product hydrogen.

Hydrogen is purified chemically by preferential

combustion, by reaction with soda-line or lime, by aqueous alkalis under pressure, by absorption in ammoniacal cuprous salt solutions, by interaction with calcium carbide and by other processes which are not as commonly used.

Industrially, hydrogen is employed in many ways among which are: the catalytic hydrogenation of organic compounds, for example, oils; the fixation of nitrogen as ammonia by direct catalytic reaction; the formation of pure hydrogen chloride by interaction with chlorine; the reduction of metallic oxides for electric lamps and the displacement of air from the bulbs prior to evacuation; the oxy-hydrogen flame for welding and fusion of metals; and in the synthetic gem industry. The largest non-chemical use is in the aeronautical field. A. H. H.

HYDROGENATION, a term implying in its broadest sense, any type of reaction whereby HYDROGEN combines chemically with a material. In its popular use, however, it refers more specifically to a series of important industrial operations which involve such chemical addition of hydrogen by the aid of a catalyst (*see* CATALYSIS). One of the best known illustrations is the so-called fat-hardening process in which hydrogen is made to combine, usually in the presence of finely divided nickel, with the chemically unsaturated compounds present in certain vegetable and animal oils, for the purpose of increasing their melting point and improving their odor and taste. This important industrial application of hydrogenation has largely grown out of the researches of the French scientist, SABATIER. Another industrial hydrogenation process is the catalytic reaction of nitrogen and hydrogen to form ammonia. This process, which originated in Germany, was largely developed during the World War and represents the successful introduction of high-pressure operations in the chemical industry. Plants are now located all over the civilized world and the synthetic ammonia process represents the outstanding method for the fixation of atmospheric nitrogen (*see* NITROGEN FIXATION) for the manufacture of FERTILIZERS, EXPLOSIVES, etc. A more recent development is the high pressure hydrogenation of carbon monoxide to form METHANOL (methyl alcohol, wood alcohol), higher alcohols, and a variety of other organic compounds suitable for use as solvents. Much attention has been given lately to the German process for liquefying soft coal by catalytic hydrogenation under pressure to produce motor fuels and lubricants similar to those derived from petroleum. In this country there are now plants operating a similar hydrogenation process using petroleum rather than coal as the raw material. By this method it is possible to improve the quality and yields of burning oils, gasoline, and lubricants obtainable from a given stock. This high pressure hydrogenation of coal and petroleum is of extreme importance as a safeguard against a future shrinkage or even depletion of the world's petroleum resources. P. K. F.

BIBLIOGRAPHY.—C. Ellis, *Hydrogenation of Organic Substances;* F. Fischer, *The Conversion of Coal into Oils,* 1925.

HYDROGEN CYANIDE GAS. *See* GASES AND ATMOSPHERES, INJURIOUS.

HYDROGEN DIOXIDE, a colorless liquid, also known as hydrogen peroxide, formula H_2O_2, differing from water in that it has twice as much oxygen. It is obtained commercially by adding barium peroxide or its hydrate to a solution of sulphuric, hydrochloric, hydrofluosilicic, or phosphoric acid. It is an oxidizing agent and is used for bleaching and as an antiseptic. Its value in medicine is chiefly as a cleansing agent for wounds and inflamed membranes.

HYDROGEN-ION CONCENTRATION, a term used to indicate the acidity or alkalinity of a chemical solution. In pure water, and in any neutral solution, the number of positively charged hydrogen ions and of negatively charged hydroxyl ions which can remain in equilibrium with each other and with the molecules of water, is about 10^{-7}, or one ten-millionth, in grams per liter. The actual concentration, denoted by pH, is expressed as the logarithm of its reciprocal; thus in the case of water or any neutral solution it is written pH 7, and thus, also, larger numbers indicate fewer hydrogen ions present, or an alkaline solution, smaller numbers indicate acidic solutions.

The precise value of the concentration is experimentally determined by a number of very delicate methods, after first an approximate value has been found by means of INDICATORS. In one case hydrogen gas is passed through a solution into which is introduced a platinum electrode; this platinum will then show an electric potential, depending upon the pH of the solution, while in another method the electric potential is acquired by an exceedingly thin glass membrane, no more than 0.001 inch thick, placed between two solutions of different pH.

The hydrogen-ion concentration is of the greatest importance in nature, especially in the processes taking place in living organisms which appear to be possible only in a small and delicately adjusted interval of pH. Blood, whose average pH is 7.35 may vary between the limits 7 and 8, but should always be on the alkaline side of neutral, the delicate balance required being maintained by respiration and digestion; some plants can thrive only in an acidic soil, others, such as peas, only in an alkaline. In industry pH determinations are essential in many processes where the acidity of the solution must be rigidly controlled, as in the tanning of leather, electroplating, sugar manufacture, production of casein, in the efficient disposal of sewage; furthermore it has many medicinal applications, as in the preparation and use of insulin, and of sera. W. J. L.

HYDROGEN PEROXIDE. *See* HYDROGEN DIOXIDE.

HYDROGEN SULPHIDE. *See* SULPHUR.

HYDROGRAPHIC OFFICE, U.S. NAVY, a department charged with topographic and hydrographic surveys in foreign waters and on the high seas; the collection and dissemination of hydrographic and navigational information and data; the prepara-

tion and printing by its own personnel and with its own equipment of maps and charts relating to and required in navigation, including confidential, strategical and tactical charts required for naval operations and maneuvers; the preparation and issue of sailing directions (pilots), light lists, pilot charts, navigational manuals, periodicals and radio broadcasts for the use of all vessels of the United States and for the benefit and use of navigators generally; the furnishing of the foregoing to the Navy and other public services, and its sale to the mercantile marine of all nations and to the general public, at the cost of printing and paper. It maintains intimate relations with the hydrographic offices of all foreign countries and with the International Hydrographic Bureau, Monaco, and (through branch hydrographic offices and sales agents) with mariners and the general public.

The Hydrographic Office prepares special charts for the use of aviators, covering the coastal areas of the United States and foreign countries; disseminates through notices to aviators information relative to aids to aerial navigation and aviation facilities; prepares and publishes plotting sheets and navigational tables especially designed for aviation use; and carries out research into the science of aerial navigation.

The Hydrographic Office cooperates with the National Academy of Sciences by conducting research work in oceanography, especially in soundings and in the collection of sea temperatures. R. E. C.

HYDROGRAPHIC SURVEYING includes the determination of data required for the construction of navigators' charts, such as the depths of water; the location of sunken rocks and other dangers to navigation; the location of the shoreline; lighthouses; landmarks, and the like. It also includes the measurement of the direction and velocity of currents. The depth of the bottom is measured directly from the surface of the water, allowance being made for the stage of the tide at the time the measurement or "sounding" is taken. Soundings are taken with the lead and hand line and are located by means of two SEXTANT angles taken from the boat between signals on shore whose positions are known. For offshore work, the vessel is sometimes anchored and the position found astronomically. In fog the positions are found accurately by detonating at a point near the vessel and accurately noting the time of the explosion by a radio recording apparatus and a CHRONOGRAPH. The sound is also received at a fixed point near shore which is connected to a radio station nearby. The time of reception at the shore station is sent by radio to the ship. The comparison of these two times gives the time interval required by the sound to travel between the shore station and the ship. Knowing the velocity of sound in water, the ship is thus located on a circle of known radius whose center is at the fixed shore station. Observations from two or more shore stations fix definitely the ship's position at the instant the bomb is exploded.

Currents are measured by setting off a float attached to a line and noting the speed with which the line pays out. Sometimes CURRENT METERS are used for measuring deep currents. Sunken rocks are located by means of the wire drag which is let down to a predetermined depth and swept (by means of two power launches) over the area to be surveyed. They are then located in the same manner as soundings.

G. L. H.

HYDROGRAPHY, that subdivision of physiography concerned with the liquid surface of the earth, the depths, extents and contours of ocean basins, the forms of coastlines and the general description of currents and tides. *See also* OCEANOGRAPHY; HYDROGRAPHIC SURVEYING.

HYDROLYSIS, a chemical reaction between water and a dissolved salt which results in the formation of an acid and a base. Hydrolysis is thus the reverse of neutralization, as is evident from the following formulation:

$$\text{salt} + \text{water} \underset{\text{hydrolysis}}{\overset{\text{neutralization}}{\rightleftharpoons}} \text{acid} + \text{base}$$

This reaction is, in fact, a "reversible" one, reaching the same state of equilibrium whether we start with the salt and water or with solutions of the acid and base. Hydrolysis occurs whenever either or both the acid and base are weak, i.e., are only slightly dissociated into their ions (*see* IONIC THEORY). Thus sodium chloride (formed from sodium hydroxide and hydrochloric acid, both highly ionized) does not hydrolyze, while sodium acetate, ammonium chloride and ammonium acetate all hydrolyze in solution (acetic acid and ammonium hydroxide are but weakly ionized). Altho the extent of hydrolysis is generally small, it will nevertheless confer noticeably acid or alkaline properties upon the solution of a salt if either the acid or base of the salt is the stronger. The acidity or alkalinity may be detected by means of a suitable indicator, e.g., litmus paper. *See also* SAPONIFICATION. L. O. C.

HYDROMECHANICS, a science concerned with fluids at rest or in motion. It may be divided into two branches: HYDROSTATICS, which deals with the equilibrium of fluids at rest; and HYDRODYNAMICS, which has to do with their motion.

The diffusive properties of gases and the diffusion and slow evaporation of liquids can be adequately explained by the KINETIC THEORY, which assumes that fluids and gases are composed of separate particles, ATOMS or MOLECULES, in motion. In hydromechanics, a fluid is treated as a continuous substance, and the phenomena of diffusion are largely ignored. As diffusion is much more marked in gases than in liquid, the science may be expected to explain the mechanics of liquids more perfectly than it does the mechanics of gases, this is indicated by the prefix, *hydro,* from the Greek for water.

The theory of hydrostatic pressure makes it clear that the free surface of a liquid at rest is nearly a

horizontal plane, while the theory of SURFACE TENSION explains why the surface rises or falls in the neighborhood of the walls of the containing vessel. The phenomena of surface tension may be ignored in a preliminary treatment of the subject, attention being confined chiefly to the main body of the fluid, generally treated as nearly or actually homogeneous. The nature of the fluid alters so slowly that capillary changes (*see* CAPILLARY WAVES) may be ignored except at the boundaries between two different fluids. In many hydrodynamical problems, the DENSITY of the fluid is assumed constant. However, with large masses or high velocities, the assumption of constant density may not be permissible. Such generalizations as BERNOULLI'S THEOREM, PASCAL'S LAW and ARCHIMEDES PRINCIPLE come within the province of hydromechanics. E. J. M.

BIBLIOGRAPHY.—A. H. Gibson, *Hydraulics and its Applications,* 1925; F. C. Lea, *Hydraulics,* 1922.

HYDROMETERS, instruments used to test the DENSITY of liquids of a weight that is either greater or less than that of water. The density of a substance is the mass per unit volume, and is expressed by the equation, $D = \frac{M}{V}$, where D is the density, M the mass and V the volume.

The portion, V, of a floating body immersed in a liquid depends upon the density of the liquid, for the product of the density of the liquid and the volume of the immersed part gives the weight of the displaced liquid, or the weight of the body (*see* ARCHIMEDES PRINCIPLE). Hence, the displacement of a floating body immersed in different liquids may be used to find the densities of the liquids. The hydrometer, shown in Fig. 1, depends on this principle. It consists of a glass tube with a bulb, B, and a smaller bulb, A, in which mercury or shot is placed in order to make the instrument float upright; the upper end,

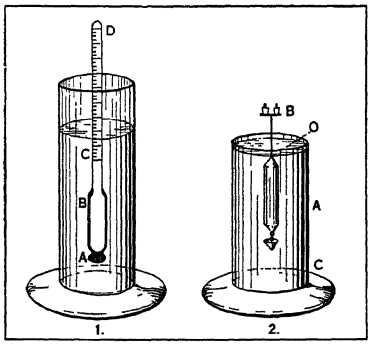


FIG. 1 FIG. 2

C—D, is graduated to give densities. There are usually two kinds; one for liquids heavier than water, and another for liquids lighter than water. They are commonly used to test the density of solutions in storage batteries and in automobile radiators in winter. This is the constant-weight type.

Another form, shown in Fig. 2, is called Nicholson's hydrometer. In this form the stem has a single mark, O, and is always sunk to this mark, so that the volume immersed is constant. Attached to the float, A, are two scale-pans, B and C, the lower one being weighted so that the instrument can float upright. To find the density of a liquid, the instrument is first floated in water at a known temperature, and weights are placed on the pan, B, till the mark, O, coincides with the surface of the water. If W is the weight of the hydrometer, and W_1 the weights added, then, the weight of the water displaced is $W + W_1$, and the volume of the displaced water is given by the equation, $V = \frac{W + W_1}{D}$, where D is the density of water at the given temperature.

If the instrument is now floated in a liquid of density, D_1, and a weight, W_2, placed on the pan, B, is required to bring the mark to the surface of the liquid, then the weight of the liquid displaced is $W + W_2$. Since the volume of the liquid displaced is the same in the two cases, we may write

$$V = \frac{W + W_1}{D} = \frac{W + W_2}{D_1} \text{ or } D_1 = \left[\frac{W + W_2}{W + W_1}\right] D$$

If the weights are in grams, the density is in grams per cu. cm.

This instrument may also be used for finding the density of solids. The hydrometer is floated in water, the solid is placed on pan, B, and weights, W_3, added to bring the mark to the surface of the water. Since it required W_1 grams to sink the instrument to the zero mark when the solid was not on the pan, it is obvious that the weight of the solid is $W_1 - W_3$. The solid is now placed in the lower pan, C, and a weight, W_4, is found which will sink the instrument to the required mark. The solid when immersed in water will lose in weight an amount which is equal to the weight of the water displaced. This is equal to VD when V is the volume of the solid. Hence, $VD = W_4 - W_3$. From the definition of density we get $D_1 = \left[\frac{W_1 - W_3}{W_4 - W_3}\right] D$ as the density of one cu. cm. E. J. M.

HYDROPHOBIA, or **RABIES,** an acute, specific, invariably fatal disease of the nervous system, caused by an unknown virus which is transmitted by the bite of an infected "mad" dog.

The behavior of an infected animal is always suspicious or alarming. It is restless and excited, licking or gnawing at all objects, living or inanimate. The appetite is perturbed, but water is not refused. Frothy saliva lather drools from the mouth; the bark is terminated by or altered into a peculiar, terrifying howl. Finally it wanders many miles, usually in a straight line, biting whatever comes within its path, until it dies of exhaustion and paralysis.

A bitten person shows no symptoms until about two months later. The bite heals normally, though it later becomes painful. The individual becomes irritable, depressed, and is seized with inexplicable fear. This state passes into extreme irritability and terror, accompanied by spasms, especially of the

muscles of the throat and chest. The spasms of the voice muscles account for the "barking" sounds sometimes noted. Sight of water or even the suggestion of it precipitates the patient into violent mania. During maniacal attacks he may attempt to bite his attendants. Prostration and paralysis follow. The patient who has developed symptoms invariably dies.

Though there is no treatment for the disease, fortunately it can be prevented if prophylactic measures are begun immediately. These are to inject under the skin of a recently bitten patient the weakened virus of rabies obtained from the spinal cords of rabbits who have previously been inoculated with the disease from another source. "Pasteur institutes," so named from the discoverer of the treatment, exist throughout the world to supply this prepared material and to carry out the treatment. If the dog is known to be mad, the virus is used immediately; if only suspected, the dog is made a captive for four weeks. If it is normal at the end of this period the virus should not be administered, as it occasionally produces unpleasant symptoms. If found to be infected, it is by no means too late for prophylaxis.

Muzzling of all dogs is the only satisfactory way to eradicate the disease. The Scandinavian countries have for many years been entirely free of hydrophobia, and the number of cases in other countries has been greatly diminished by this simple measure.

The virus is transmitted entirely by the nervous system, passing up the nerves to the nerve cell-bodies. The presence of minute rounded "Negri bodies" within the nerve cells is characteristic of the disease. It is these, found in the body of a dead suspected dog, which confirm the diagnosis. W. J. S. K.

HYDROPHYTE, a plant adapted to life in water, very wet places, or saturated atmosphere. Submerged hydrophytes have little mechanical tissue, no stomata, and few or no intercellular spaces or air-cavities. In floating hydrophytes, as the water-lily, the stomata are on the upper side of the leaf and aerating tissue is well developed, leading from the leaves to the submerged parts. Amphibious hydrophytes including most plants of swamps and marshes, rooting in water but with leaves and stems wholly or partly in the air, differ but little in structure from MESOPHYTES.

HYDROPLANE, a flat or nearly flat bottom boat with one or more steps or planes, driven by a high speed motor. Hydroplanes are designed to lift and run over the surface of the water on their steps or planes. Speeds in excess of 50 miles an hour have been obtained. The term, hydroplane, is sometimes applied to SEAPLANES.

HYDROQUINONE, an organic chemical substance consisting of a benzene ring with two hydroxyl groups, $C_6H_4(OH)_2$, also known as para-dihydroxybenzene. It is made synthetically from aniline, by first oxidizing, then reducing it, and is widely used as a photographic developer, since it imparts a deep blackness to the image.

HYDROSOLS, colloidal dispersions of any substance in water. (*See* SOLS.)

HYDROSPHERE, the liquid part of the earth's surface, as contrasted to the ATMOSPHERE, which represents the gaseous envelope, and the LITHOSPHERE, or solid crust. It comprises the OCEANS and SEAS, and its total volume approximates 324 million cubic miles. Its mass exceeds that of the atmosphere about 260 times, but contributes only 1/4300 part to the total mass of the earth. The principal subdivisions are the three great oceans, the Atlantic, Indian and Pacific with the numerous landlocked and fringing seas and gulfs. *See* OCEAN.

HYDROSTATICS, the branch of physics which concerns fluids at rest. Two cases may be mentioned; first, fluids at rest under the action of gravity; second, those cases where the fluids are at rest or are moving very slowly and are contained in closed vessels in which pressure acts upon the fluid, as in hydraulic elevators and presses (*see* HYDRAULIC POWER TRANSMISSION).

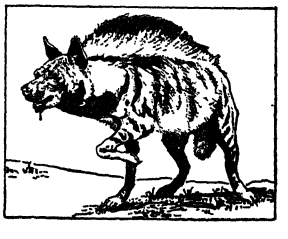
Under hydrostatics are considered such questions as the distribution of pressure in a fluid, PASCAL'S LAW, and the variation of pressure with the depth of a fluid (*see* FLOATING BODIES, EQUILIBRIUM OF).

E. J. M.

HYDROXIDES, chemical compounds containing the hydroxyl radical (OH), combined with another element or radical. In general, the term "hydroxide" is restricted to the hydroxides of basic or metallic elements or radicals, as potassium hydroxide, KOH; zinc hydroxide, $Zn(OH)_2$ and aluminium hydroxide, $Al(OH)_3$. The most stable hydroxides are those of alkali metals.

HYDROXYLAMINE, an inorganic chemical compound of formula NH_2OH, somewhat unstable, though the amino-group NH_2 is stable in salts and organic compounds. Its solution in water has an alkaline reaction and possesses properties similar to those of a solution of ammonia, into which it may be converted by reduction.

HYDRUS (gen. *Hydri*), the male watersnake, a constellation near the south celestial pole in the form of a large triangle. The brightest star, Beta, of the third magnitude, is sometimes called the south pole star, though it is more than 12 degrees distant from the pole. Near Beta Hydri, in the constellation Tucana, lies the small MAGELLANIC CLOUD. *See* STAR: *map*.



HYENA

HYENA, a mammal of the family *Hyænidæ*. The hyenas proper are the striped of north Africa and India, the spotted of central Africa, and the small brown "strand-wolf" of South Africa. They are about the size of large dogs, are stoutly built, but with weak hindquarters, have grayish-brown shaggy coats, big heads, and powerful jaws armed with very large teeth. In their habits they are nocturnal and savage; they will devour small creatures, rob native villages of

lambs and poultry, and occasionally seize a sleeping man; but they principally subsist on carrion, dogging the trail of lions and leopards to feed on the remains of their victims. Hyenas howl dismally, and are more hated than feared by natives and travelers in the wilderness, who accuse them of grave-robbing, cowardice, and uselessness. The AARD-WOLF, family *Protelidæ,* closely related to hyenas. E. I.

HYGIEIA or HYGEIA, in Greek mythology, daughter of Asclepius and goddess of health, is represented as a maiden with long robe and a cup in her hand from which a serpent is drinking. In Rome she was called Valetudo

HYGIENE, a word derived from Hygieia, meaning the *science* of preserving health. Its rules, regulations, and principles are based in theory upon scientific facts. In practice, however, hygienic rules at times are poor adaptations of fact, or are too sweeping in scope, or are insufficiently supported by facts. Nevertheless, the spirit of modern hygiene is scientific.

The varieties of hygiene are indeed numerous, due to the many fields of human endeavor to which the facts about living may be applied. This definitive aspect of the matter may be carried to extremes in an effort to isolate and make explicit the various applications of the term. Certain terms, well defined in usage, are recognized.

Personal hygiene deals with the health problems of the individual person and contrasted with those of the community. The latter is included in the term *community hygiene.* Special kinds of communities may be recognized: for example, warring groups in *military hygiene, industrial* workers in *industrial* hygiene, particular trades in *vocational hygiene,* rural peoples in *rural hygiene,* schools in *school hygiene,* etc. Special aspects of personal hygiene are recognized: for example, the teeth in *dental hygiene,* the mouth in *oral hygiene,* infants in *infant hygiene,* the sexes in *sex* or *social hygiene.* The term sex hygiene often refers to particular measures for the prevention of venereal diseases, to menstrual functions, etc., but social hygiene is much broader. It "aims at the best possible development of all *physical, psychial,* and *social* aspects of life as it is determined or influenced, directly or indirectly, by the sexual instincts and related traditions." There are other uses of the term hygiene, as in *racial hygiene, educational hygiene,* etc.

The terms *hygiene* and *sanitation* are often used interchangeably, and by definition mean much the same thing. By custom, however, sanitation has come to mean more particularly the use of agencies and procedures by the community for health control of the environment. Thus sanitation and community hygiene are much the same. Sanitation deals specifically with water, food, sewage, housing, etc.

The relationship of hygiene to the field represented by the term health education is that of the part to the whole. Health education may be said to include two administrative fields: (1) health education in public health organizations, such as the boards of health in cities, counties, or states and the United States Public Health Service; and (2) health education in schools. In the public health fields, the facts of the various fields of hygiene are disseminated to the public in a variety of ways. In addition, the regulatory activities of these organizations may have large educational contributions, as in the operation of *quarantine* for the exclusion of patients with communicable disease, such as scarlet fever. Health education in schools may be divided into three classes: (1) *Health supervision of school plants and school processes.* This includes the older *school hygiene,* which deals with problems of ventilation, lighting, seating, fire hazards, decoration, cleaning, toilets, water supply, etc.; and the *hygiene of instruction,* which considers the hygiene of the learning process, the prevention of undue fatigue, matters of discipline, length of the school day, recesses, etc. (2) *Health service* is an extension, elaboration, and more complete development of *medical inspection.* It includes the inspection and examination of children for remediable defects, the follow-up of cases for treatment, vaccination, immunization against diphtheria, etc. (3) *Health instruction* is instruction in hygiene. It considers the habits, skills, attitudes, and knowledges important for health.

The value of hygiene cannot be stated readily. In the field of preventive medicine, its results are often tangible. For example, in Auburn, New York, the reduction of morbidity (rate of illnesses) and of mortality (rate of deaths) from diphtheria for the years 1922 to 1930 is a striking proof of the value of immunization measures. Again, the use of typhoid inoculation in the U.S. Army during the World War profoundly illustrates the value of this measure. (From September 1, 1917, to May 2, 1919, there were 213 deaths from typhoid fever. If the rate had prevailed during the World War that existed in the army during the Spanish-American War, there would have been 65,292 deaths.) The values in a pure water supply can be readily shown by cities like Pittsburgh and Cincinnati, for they can contrast their mortalities before and after they had pure water. This kind of evidence is tangible, direct, and convincing. Over and beyond these values, however, that may be expressed readily in lives saved, or in dollars and cents if the worth of human lives may be estimated in money, there are indirect and quite intangible values that appear to many to be very much worth recognition and statement. They arise out of the ideas promoted by the teaching of hygiene and are expressed in higher levels of living that goes on. Some of the more significant characterizations are the emphasis upon the out-door life, the athletic vogue, the camping movement, the training ideals, etc. Such cannot be measured easily in money. To essay their worth in human happiness is quite impossible. To recognize their contribution to individual and national health is the simplest matter of common sense.

The meaning of hygiene in modern interpretations of health is much broader than merely the prevention of disease. Although our word "health" is de-

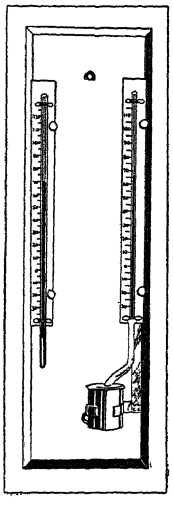
rived from the Old English word halth, which means the condition of being safe and sound, to-day "health" has a much more significant meaning and connotes broader aspects than freedom from disease. Health in this modern usage means keeping oneself at the highest levels of efficiency, and living at one's best. In this view social ends and values are recognized along with the personal. In this conception, health in a positive, developmental view is a standard of inspiration and increasing achievement. J. F. W.

HYGINUS, ST., bishop of Rome, 137 (?)-140 (?). His feast day is Jan. 10 (11).

HYGROMETER, an instrument for measuring relative HUMIDITY and DEWPOINT.

Experiment shows that the amount of water vapor a given volume of air can hold depends entirely on the temperature of the air. When the air can hold no more, it is said to be saturated. The per cent of saturation, i.e., the relative humidity, h, may be defined as the ratio of the vapor pressure in the air at any time to the pressure it would have if it were saturated at the same temperature. It is stated by the equation, $h = \frac{p}{P}$, where p is the vapor pressure and P the pressure of saturated water vapor at the same temperature.

Since P for all temperatures can be found in tables, it remains only to find p to obtain the relative humidity. To do this, the dewpoint is necessary. The dewpoint is defined as the temperature at which the water vapor in the air would saturate it. This temperature may be found by cooling the air until dew forms. The instrument for finding it is called a *dewpoint hygrometer.* In its simplest form it is a small vessel, with a polished surface, which contains a highly volatile liquid like ether, that is cooled by bubbling air through it, or which contains water cooled by ice. The temperature at which the dew appears on the polished surface is noted. The liquid is then allowed to warm slowly and the temperature at which the dew disappears is noted. The average of these two readings is the dewpoint. The pressure corresponding to this temperature in the table of saturated water vapor will be p. With these data the relative humidity may be calculated.



WET AND DRY-BULB HYGROMETER

The wet and dry-bulb hygrometer, another device for finding the relative humidity, depends for its action upon the fact that the drier the air is the more rapid will be the evaporation from a wet body exposed to the air. Since evaporation requires heat, it follows that the extent of the cooling of a wet body by evaporation is a measure of the relative humidity of the surrounding air. Two similar thermometers are fixed on a board, one of them covered with muslin kept moist by a piece of lamp wick in water. Unless the air is saturated, evaporation will take place from the muslin, and the wet-bulb thermometer will indicate a lower temperature. The relative humidity is obtained from the difference between the temperature of the wet and dry bulbs.

HYKSOS, an Egyptian dynasty of Semitic origin whose name signifies the Shepherd Kings. The Hyksos dynasty is generally admitted to be the 16th dynasty of the Old Egyptian Empire, and these conquerors were apparently expelled about 1600 B.C. by a native Egyptian uprising. A united Egypt animated by a universal hatred of the Hyksos was enabled to extend its conquests as far as the Euphrates. *See* EGYPT, ANCIENT.

HYMANS, PAUL (1865-), Belgian statesman and author, was born at Brussels Mar. 23, 1865. He was educated in his native city and became a member of the Belgian House of Representatives in 1900. He was envoy to England in 1915-17, plenipotentiary to the Paris Peace Conference in 1919, and a member of the Council of the League of Nations. He was first appointed minister of foreign affairs in 1918, and was minister of justice in 1926-27.

HYMEN or **HYMENAEUS,** in Greek mythology the god of marriage, generally said to be the son of APOLLO and one of the MUSES, although some legends assert he was the son of Dionysus (*see* BACCHUS and APHRODITE).

HYMENOPTERA, a large order of insects, containing some 60,000 species. It includes ants, bees, wasps, ichneumon flies and saw-flies. Members of this order have two pairs of membranous wings, of which the fore-pair is the larger, held together by tiny hooks. Their mouths are adapted for biting, and they usually have a "tongue" for sucking or lapping. Most of them have thin waists. Many species are parasitic during at least part of their lives. The majority are solitary, but ants and certain bees and wasps, are social insects, exhibiting very remarkable communal organizations. Even among the solitary species instinctive behavior has reached a high degree of development. In nearly all cases some provision is made by the adult insects for the feeding of the larvæ after the eggs hatch, and nests are frequently constructed. The young may be caterpillar-like as in saw-flies or maggot-like as in ants. They usually pass the pupal stage in cocoons.

HYMETTUS, a mountain of Attica, southeastern Greece, extending from Athens east and southeast for about 5 mi. Trelo-Vouni is the modern name; the highest point is about 3,400 ft. Hymettus is celebrated for its bluish marble and honey.

HYMN, a religious poem or ode usually arranged in stanzas and set to music. Many great English poets, including John Donne, George Herbert, George Withers, Robert Herrick and William Cowper have written hymns. Still more famous are the Wesley brothers and Thomas Ken, Bishop of Bath and Wells (1637-1711), who wrote *All praise to Thee, my God, this night* which ends with the Doxology, and *Awake my soul and with the sun.* Samuel Wesley (1691-

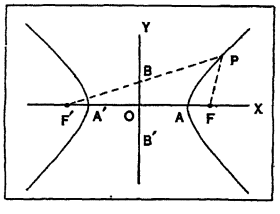
1739) wrote many hymns of which several are still common, and his brothers Charles and John Wesley (1703-91) produced 64 hymn books between 1736 and 1786. Of the 6,000 hymns written by Charles Wesley (1717-88), *Christ the Lord is Risen today, Hark, the herald angels sing, Oh, for a heart to praise my God* and *Jesus, lover of my soul* are among hundreds still sung to-day. American writers who produced beautiful hymns are JOHN GREENLEAF WHITTIER, OLIVER WENDELL HOLMES and Dr. Ray Palmer.

HYNDMAN, HENRY MAYERS (1842-1921), British Socialist, was born at London, Mar. 7, 1842. He was educated at Cambridge. In 1863-68, as correspondent for the *Pall Mall Gazette,* he traveled in Europe and America. In 1881 he founded in England the Socialist Democratic Federation which became an active Socialist organization, advocating Irish freedom, justice to India and an eight-hour day. Hyndman's many writings include *Socialism and Slavery* and *A Commune for London.* He died at London, Nov. 22, 1921.

HYOSCINE, a synonym for SCOPOLAMINE.

HYOSCYAMINE, an alkaloid obtained from hyoscyamus and other plants of the nightshade family. It is used chiefly in the form of the hydrobromide ($C_{17}H_{23}O_3N.HBr$), which occurs as white odorless crystals. Medicinally its action is similar to that of ATROPINE, though it is possibly more sedative to the brain; at times it causes acute delirium. Hyoscyamine and its salts are *extremely poisonous.*

HYPATIA ("or New Foes With an Old Face"), a historical romance by CHARLES KINGSLEY; published 1853, dealing with the strife between Christianity and Paganism in 5th century Egypt. Hypatia, famed for her beauty, purity and wisdom, was the daughter of a renowned Alexandrian scholar, and was herself a noted lecturer until, with her devotion to Neo-Platonism, she was grossly misunderstood and put to death by fanatical monks. The novel is full of emotional and dramatic situations, and offers a superb picture of Hellenist Egypt and its evil brood of heresies.



HYPERBOLA. F AND F′ ARE THE FOCI

HYPERBOLA, a curve which is the locus of a point moving so that the difference between its distances from two fixed points, the foci, in the plane is constant. In this figure $F'P - FP$ is constant and is represented by $+2a$ or $-2a$ depending on whether $F'P > FP$ or is less. AA' is the transverse axis, O is the center, A and A' are the vertices, $A'O = AO = a$, $OF = +c$, and $OF' = -c$, $OB = b = \sqrt{c^2 - a^2}$ and BB' is the conjugate axis. The standard equation of the hyperbola is $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. *See* CONICS.

HYPERBOLE, magnifying things far beyond their real bounds to make them more impressive or more vivid, as when one speaks of waves as mountain-high. The exaggeration is unmistakable, but at the same time suggests strong emotion on the part of the speaker or writer and fixes attention upon whatever quality he wishes to emphasize. Hyperbole is frequently used for humorous effect, and when used to excess leads to bombast.

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HYPERBOLOID, a solid generated by the revolution of a hyperbola about one of its axes; in modern geometry, a surface having for its equations

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1, \text{ or } \frac{x^2}{a^2} - \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1,$$

the former giving a simple hyperboloid, or a hyperboloid of one sheet, and the latter giving a double hyperboloid, or a hyperboloid of two sheets. In each case the cross sections shown (the xy contour in the former and the yz contour in the latter) is an ellipse, of which the circle is a special type. *See* SOLIDS, ELLIPSOID, and PARABOLOID.

HYPERBOREANS, in Greek mythology, a race who lived beyond Boreas, the north wind. They lived in perpetual sunshine and possessed eternal youth. The name was later given to any people dwelling in the far north.

HYPERELLIPTIC FUNCTIONS, a special type of ABELIAN FUNCTIONS.

HYPEREMIA. *See* PATHOLOGY.

HYPEREMIA, ARTIFICIAL. *See* LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE.

HYPERFINE STRUCTURE. *See* LINE SPECTRUM.

HYPERICUM, a numerous genus of the garcinia family (*Guttiferæ*) comprising about 220 species. They are mostly perennial herbs, though a few are subshrubs and small trees, and are found chiefly in subtropical and north temperate regions. Various shrubby species with evergreen leaves are planted for their attractive flowers and foliage, including Aaron's beard (*H. calycinum*), native to southeastern Europe, and the gold-flower (*H. Moserianum*), a garden hybrid originated in France. About 35 species grow wild in the United States; most of these are commonly called St. John's-wort.

HYPERION, in Greek mythology, son of URANUS and GAEA, father of HELIOS and husband of Thea. In late mythology this name was occasionally given to APOLLO.

HYPEROPIA. *See* AMETROPIA.

HYPERSENSITIVENESS. *See* ALLERGY.

HYPERTROPHY, exaggerated growth of a tissue or organ. Hypertrophy generally follows lines of normal growth, and is associated with relatively unimpaired or increased function. Excessive overgrowth of a tissue, with consequent loss of its proper function, constitutes a TUMOR.

A normal degree of growth is established by a balance between internal secretions, by the influence of surrounding structures, by factors within the cells

themselves, and by nervous influences. When these become altered, hypertrophy, or its opposite, ATROPHY, results. Unfortunately, the mode of action of these factors is to a great extent unknown, but an understanding of them is essential for a proper approach to the problems of cancer and other tumors.

Hypertrophy of the voluntary muscles is induced by their excessive use. Such a response occurs in the muscle of the heart wall in athletes. Irritation or inflammation is the cause of hypertrophy of the tonsils, bladder, or prostate. Under such conditions overgrowth is generally a response of the connective tissues. *See also* ACROMEGALY; PATHOLOGY.

HYPNOTISM considers the trance-like state of hypnosis, in which the subject's behavior is controlled by the suggestion of another. The subject may in part be aware of his surroundings; usually on awakening he is without memory of his actions in the abnormal condition. Hypnosis is an altered state of consciousness, but unlike natural sleep or artificial sleep as induced by general anaesthetics in which sensation, movement and thought are in abeyance. Its closest analogy is SOMNAMBULISM. When first recognized, 1784, by Marquis de Puysegur, a disciple of Mesmer, it was called artificial somnambulism, and the hypnotized subjects were known as somnambules. It is probable that the trance state of religious ecstasy or of oracles, and again of possession and cure by exorcism, may have been in part hypnotic.

History and Nature of the Condition. The story of hypnotism begins with Mesmer (1733-1815), who revived the notion that, as there is a mineral magnetism, so also there is an animal magnetism. At first he used magnets to draw out disease, then constructed a large tub after the pattern of an electric battery, around which the patients assembled. Later he used passes and stroking, claiming that the magnetism streamed from his own person. His claims of curing disease by this method as well as his theories were examined by a scientific commission and pronounced to be without foundation. The state was known as mesmerism until James Braid (c. 1795-1860), recognized its nature and called it neurohypnology, 1843, and later hypnotism. The stage performances of traveling hypnotists showed subjects carrying out dramatically suggested actions, shivering when told that the room was cold, panting and perspiring when told that it was hot, frightened when told a lion had entered the room, acting parts assigned to them, insensitive to pain, devoid of control.

Under a scientific study the essential facts regarding this interesting condition appeared. It is a state of DISSOCIATION to which many persons are susceptible. Its reality was demonstrated, before the days of anaesthetics, by the performance of painless surgical operations on patients in that state. About 1870 Charcot in Paris studied hypnotism in hysterical patients and distinguished different states, lethargy, catalepsy and somnambulism according to bodily symptoms. Bernheim and Liebault in Nancy referred the actions to a heightened state of suggestibility, which view came to be accepted. The use of the condition for the cure of nervous ills (*see* PSYCHOTHERAPY) then became general and, though no longer extensively practiced, is still used.

As an instrument of psychological investigation, hypnotism has distinct value. The theory of hypnosis regards the state as a form of dissociation. Charcot had shown the marked tendency of hysterical patients to be hypnotized; yet many good hypnotic subjects show slight traces of hysteria. The state, though induced by stroking, or by gazing fixedly at an object at close range, is essentially the result of suggestion; once experienced and repeated, it is entered into at the word of command of the hypnotizer. By a similar sharp command the subject is aroused and resumes the normal state.

Symptoms. It has been shown that increased sensation, as reading fine print or hearing faint sounds, increased motor control, can be induced by hypnotic suggestion; similarly that matters beyond recall in the waking state may be recovered under strong suggestion. Furthermore what occurs in one hypnotic state, may be recalled in the next. This brings hypnosis in line with somnambulism and alternating personalities. Most important is post-hypnotic suggestion, in which actions suggested under hypnosis are carried out after awakening. The subject may then feel a strange compulsion to do something unusual, such as open an umbrella indoors, and give some strained reason for it, unaware of the source of the impulse. Remarkable observations have been made on the power of good hypnotic subjects to carry out actions after a stated time, specified hours and minutes, later, or at a stated hour in the future. How the passage of time is subconsciously registered remains in doubt. Yet hypnosis confers no powers unprovided for in the conscious endowment; it brings out latent knowledge. It would be futile to suggest to one who knows no French to speak in that language. However, the question of transcending ordinary capacities in trance states is full of complications. (*See* TRANCE; AUTOMATISM). Some spiritualistic mediums may enter a hypnotic or allied state. A hypnoidal state of relaxed attention, with surrender of sensation and movement, is at times utilized for curative precedures. Similar states occur in entering into and emerging from ordinary sleep.

Recent experiments have utilized the hypnotic state for the solution of specific problems in psychology. It has thus been established that a suggestion that the subject is falling over is far more effective when the subject is hypnotized than when awake. The exploration of a large range of problems in the relations of conscious and subconscious control is possible by this method. J. J.

BIBLIOGRAPHY.—The most complete and authoritative work is that of Bramwell, *Hypnotism: Its History, Practice and Theory,* 1903.

HYPOCHLORITES, chemical compounds characterized by having one oxygen atom attached directly to one chlorine atom to form the OCl radical.

Bleaching powder, produced by treating hydrated lime with chlorine gas, is an impure double salt, $CaCl_2\,Ca(OCl)_2\,xH_2O$, containing up to 40% "available chlorine." Percentage "available chlorine" equals twice the percentage "hypochlorite" chlorine, and gives the weight of elemental chlorine to which 100 units of the compound is equivalent in bleaching power. (*See also* BLEACHING; CHLORINE.)

Bleach liquor: A solution of calcium or sodium hypochlorite used for bleaching cellulose fibers, and sweetening refinery oils.

Calcium hypochlorite, $Ca(OCl)_2$. The pure salt contains 99.2% "available chlorine." Prepared by chlorination of lime and crystallization of the $Ca(OCl)_2{\cdot}2H_2O$. The dry salt is relatively stable.

Sodium hypochlorite, NaOCl. Prepared by chlorinating sodium hydroxide or carbonate with the reaction: $2NaOH + Cl_2 \rightleftharpoons NaCl + NaOCl + H_2O$.

Prepared also from $Ca(OCl)_2$ by addition of Na_2CO_3, and by direct electrolysis of NaCl solution. The pentahydrate $NaOCl{\cdot}5H_2O$ may be crystallized from a concentrated solution. The anhydrous salt is unstable.

Hypochlorous acid reacts with alcohols to produce insoluble oily alkyl hypochlorites. The tertiary alcohols give the most stable compounds, e.g., $(CH_3)_3\,C\,OCl$ (tributyl hypochlorite). R. B. M.

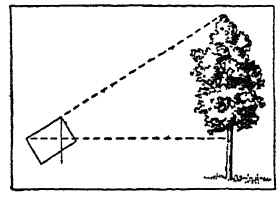
HYPOCHONDRIASIS, a state of mind, found in many nervous and mental diseases, characterized by an exaggerated apprehensiveness and solicitude for one's own health. Patients with hypochondriasis commonly complain of a multiplicity of symptoms related to any part of the body, and these are often bizarre and grouped in a non-physiologic manner. It is, however, the state of fear in which these symptoms are regarded by the patient as threatening his health, his life, or his sanity that characterizes hypochondriasis. As a result of this fear, such a patient directs most of his attention to his own body and apprehensively discovers each day new and ominous symptoms.

This preoccupation with oneself is most often a personality characteristic attributable to childhood influences and training; the immediate occasion of the acute state may be a relatively simple difficulty of adjustment in the spheres of sex or ambition. More rarely, other forms of hypochondriasis occur, such as that seen in manic-depressive psychosis, where the causes are probably metabolic and not related to training or environment. The symptoms in such cases usually are different, however.

The proper diagnosis and treatment of hypochondriasis must include not only a recognition of the condition, but an effort to uncover the nature of the maladjustment, and to instruct the patient in a more healthful attitude. In such treatment medication has very little place. R. P. MA.

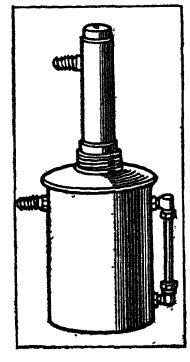
HYPOSULPHITES, salts of hyposulphurous or thiosulphuric acid, $H_2S_2O_3$, also called thiosulphates, formed by the reaction of acid sulphites with metals, as zinc, tin and iron. Hyposulphite of soda (thiosulphate of sodium), $Na_2S_2O_3$, is used in photography as a fixing agent and to remove chlorine remaining after bleaching.

HYPSOMETER, a device for measuring altitude. The geometric type of hypsometer consists of a square and is used to find the heights of objects through the use of similar triangles and with practically no computation. A simple hypsometer may be made by tacking a sheet of coordinate paper to a board, and suspending a plumb line from a tack driven in the top of the board where vertical and horizontal lines of the coordinate paper cross. When the top edge of the board is sighted on the top of the object to be measured, the plumb line will form with the lines on the paper a triangle similar to the one having the object to be measured for a side. If the distance from the observer to the object is known, the height may be found from the scale of the coordinate paper. If the hypsometer is held above the ground the height found from the scale must be added to the height of the observer, the sum representing the height of the object.



RECTANGLE USED AS HYPSOMETER

The barometric hypsometer is a portable apparatus used to find the BOILING POINT of water from which the atmospheric pressure and, subsequently, the altitude, are determined. It consists of a cylindrical metal water chamber surmounted by a smaller double-walled cylinder, tall enough to contain a thermometer. A suitably shielded spirit lamp or burner is housed below the water chamber. The steam passes up the inner cylinder; completely surrounding the thermometer, and then down between the two cylinders, thus eliminating premature condensation. This method was formerly used for finding the height of mountains, as the hypsometer is more portable than a mercury BAROMETER. However, development of accurate ANEROID BAROMETERS has rendered the hypsometer more or less obsolete, and its chief use to-day is in calibrating thermometers.



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HYPSOMETER FOR MEASURING BOILING POINT

HYRAX, a genus of small mammals of Africa, Arabia, and Syria, outwardly resembling cavies, but in structure distantly related to elephants. They are known to the Dutch of South Africa as rock-rabbits, but in English books are usually named conies, and identified in Palestine as the "feeble folk" spoken of in the Bible (Proverbs 30:26). Their general habits are those of a rock-dwelling marmot, and their wariness is such that specimens are collected with great difficulty.

HYRCANUS, JOHN or JOHANAN (135-106

B.C.), high priest of the Jews and prince of the Asmonean family, was the son of Simon Maccabeus. As a young man, he distinguished himself by a victory over the Syrian general, Cendebaeus. When Simon was treacherously slain by his son-in-law, Ptolemy, John Hyrcanus escaped the same fate by fleeing to Jerusalem, where he was immediately acknowledged high priest (135 B.C.). The Syrians being torn by internal conflict at the time, Hyrcanus took advantage of their confusion to drive them from Palestine. He also subdued the provinces east of the Jordan, and forcibly converted the Idumaeans and Samaritans to Judaism. By his conquests, which were subsequently confirmed by the Romans, Hyrcanus consolidated Judea into a united, independent nation. The last years of his wise and just rule were disturbed by bitter factional strife between the two chief parties of Judea, the Sadducees and the Pharisees. Hyrcanus died in 106 B.C. leaving five sons, Judas Aristobulus, Antigonus, Alexander, Absalom, and a fifth whose name is unknown.

HYSLOP, JAMES AUGUSTUS (1884-), American entomologist, was born at Chicago, Ill., July 7, 1884. He graduated from Massachusetts Agricultural College in 1908 and took his M.S. at Washington State College in 1911. In 1906 Hyslop directed the first campaign against the gipsy moth in Connecticut. The following year he entered the United States Department of Agriculture and took part in the work against the boll weevil. From 1912-17 Hyslop was in charge of the Hagerstown, Md., Field Stations and in 1917 became entomologist in charge of the Office of Insect Pest Survey in the United States Department of Agriculture.

HYSLOP, JAMES HERVEY (1854-1920), American psychologist, philosopher and exponent of psychical research, was born at Xenia, O., Aug. 18, 1854. He studied at the University of Leipzig (1882-84) and received his Ph.D. degree at Johns Hopkins University in 1887. Hyslop became professor of logic and ethics at Columbia University and taught there from 1895 to 1902. In 1903 he left Columbia to organize and direct the American Institute for Scientific Research that later became the American Society for Psychical Research. He also acted as the editor of the *Journal* of this society until the end of his life. Among his better known works are *Elements of Logic,* 1892; *Elements of Psychology,* 1895; *Democracy,* 1899; *Elements of Ethics,* 1900; *Problems of Philosophy,* 1905; *Science and the Future Life,* 1905; *Enigmas of Psychical Research,* 1906; *Borderland of Psychical Research,* 1906; *Psychical Research and Survival,* 1913; *Poems,* 1915; *Life after Death,* 1918; *Contact with the other World,* 1919. Hyslop died in New York City, June 17, 1920.

HYSSOP (*Hyssopus officinalis*), a hardy, strong-scented perennial of the mint family, grown as an ornamental border plant. It is a native of Europe and Asia, somewhat naturalized in the United States. The slender stems, about 1½ ft. high, bear narrow leaves and handsome blue flowers in terminal spikes. Hyssop is sometimes used in domestic medicine and as a potherb.

HYSTERESIS. *See* MAGNETIC INDUCTION.

HYSTERIA, a nervous condition characterized by manifestations of exaggerated emotion and lack of self-control. Hysteria was, until quite recently, thought to be largely confined to women and its nature was frequently mistaken, because its manifestations are so often physical: for example, various types of paralyses, such as paralysis of the arms or legs, hands or fingers, or of some of the eye muscles, particularly the eyelids, and disorders of sensations, especially lack of sensations, such as lack of feeling over skin areas and various parts of the body, or lack of capacity to see, hear, taste, or smell.

When the nature of hysteria finally came to be known, it was learned that it was not by any means a disorder confined to young girls, although perhaps they develop certain rather characteristic features more frequently. The nature of the disorder is primarily mental—not mental in the sense of being a disturbance of the factors of intelligence, but mental in the sense that it is a disturbance in the emotional sphere, the realm of feeling—and the various apparent physical disturbances can be related as the natural consequences of the disturbances of the emotions when the meaning of these disturbances is worked out. For example, a person has a paralyzed arm following a railroad injury and it continues paralyzed until the suit for damages is finally settled in court. Such a paralysis is not consciously intended. The patient merely cultivates a feeling of weakness that may easily have followed the injury and deludes himself into believing in its existence. Inability to see or to hear is not always due to disturbances of seeing and hearing, but will be found on examination to be inability to see or to hear certain things, which, by investigation of the patient's past experiences, will be shown to be disagreeable and things that he wants to avoid knowledge of.

Hysteria thus tends to a dissociation or splitting of the personality in the sense that certain things go on as usual and certain other things, for example, those that the patient does not want to see or to hear, are split off and dealt with separately and in a different way.

Hysteria is a neurosis and its proper treatment is by psychotherapy. This has been intuitively known for a long time and the type of psychotherapy which in the past has been most abundantly used consisted of certain forms of suggestion. Nowadays, however, the feeling is that suggestion, while it may at least temporarily improve conditions materially, does not get to the root of the difficulty, and other forms of psychotherapy have been developed which have this more ambitious purpose in view. When the entire purpose of the symptoms, in accordance with this type of therapy becomes known to the patient, then not only do the symptoms disappear, but the production of further symptoms from the same sources is no longer possible. W. A. W.

I

IASI. *See* JASSY.

IATROCHEMISTRY. The fruitless search of the alchemists for the Philosopher's Stone had inevitably caused the study of many diversified substances. Closely connected with the idea of transmutation, there arose the thought that it would be possible through the Philosopher's stone to preserve health and prolong life. Although this proved to be another delusion, the medicinal properties of many old and new compounds were investigated during this Iatro or Medical period. (*See* CHEMISTRY: History of Chemistry.)

The leading figure is the picturesque PARACELSUS who taught the close interrelation of chemistry and medicine. This made for considerable progress in chemical knowledge. Even though the alchemists were still busy, chemistry began to recover from the disrepute into which it had fallen through their fraudulent practices. P. M. A.

BIBLIOGRAPHY.—E. von Meyer, *History of Chemistry.*

IBAGUÉ, the capital of the state of Tolima, Colombia, situated 4,300 ft. above sea level and about 60 mi. to the west of Bogotá. It lies on a fertile plain watered by tributaries of the Cuello River. It is connected to Bogotá by railway and to the Cauca valley by highway, making it an important trading center. It was founded in the middle of the 16th century. In 1834 it was made the capital of Colombia for a short time. Pop. 1928, 56,333.

IBÁÑEZ, CARLOS (1882-), Chilean soldier and statesman. In 1924 he began to take an active part in politics, aiding in the overthrow of Pres. Arturo Alessandri. Following the resignation of Alessandri and the election of Pres. Emiliano Figueroa, he became minister of the interior. In Feb. 1927, Pres. Figueroa was forced to take a leave of absence and Ibanez became first premier, and later vice-president. In May he was elected president, and in this capacity his rule was dictatorial and harsh, though he fostered industry and adopted an extensive educational program. Opposition grew, however, and in July 1931, he was forced to resign.

IBÁÑEZ, VINCENTE BLASCO (1867-1928), Spanish novelist and political agitator, was born at Valencia in 1867. He represented Valencia in the Spanish Parliament, and was early noted for his anti-monarchical agitatings. He was frequently sentenced to exile and imprisonment, and for this reason much of his life was spent outside of Spain. After writing several novels about Valencia, he took up in his fiction certain phases of Spanish life that he thought needed revolutionizing; among his best novels of this stage are *In the Shadow of the Cathedral, Blood and Sand* and *La Bodega. The Four Horsemen of the Apocalypse,* 1916, perhaps his most widely known novel, deals with the World War, as does also *Mare Nostrum,* 1918. Ibáñez's later work is of slight consequence because of its carelessness and its pot-boiling quality. In general, his writings and activities against the monarchy were a potent influence among the Spanish liberals and revolutionists. He died in France, Jan. 28, 1928.

IBERIAN, an extinct language preserved in glosses, coins and a number of inscriptions, mostly short and consisting largely of proper names, found in Spain. The texts, of which at least eight appear to be in an INDO-EUROPEAN language, are scarcely earlier than the 1st century B.C., and are written in an alphabet probably derived from Greek, but have not yet been translated. If, as seems probable, Iberian is represented by the modern BASQUE, it may ultimately be connected with CAUCASIAN.

BIBLIOGRAPHY.—E. Hübner, *Monumenta linguae Ibericae,* 1893.

IBERIANS, an ancient people inhabiting parts of the Spanish peninsula and whose name seems to have come from the River Iberus (modern, Ebro). The Greeks who first settled on the eastern coast of the peninsula at any rate gave the name to the natives of that region. The name of the river may itself be related to the Basque phrase *ibay-erri,* which means "country of the river." By Strabo's time, the name was commonly applied by the Greeks to the entire peninsula and its people. As regards the latter, most of our knowledge is derived from coins found widely scattered through Spain and southern France. From this testimony, the Iberian alphabet shows resemblances to both the Greek and the Punic letters, with an admixture of an older alphabet. Resting on these facts, as well as on similarities of language, a theory has been advanced that at one time a great Iberian people, distinct from the Aryan in speech and appearance, inhabited Sicily, Sardinia, Corsica, Southern France and even the British Isles. The present Basques would be the remnants of this race. Whether we call them Iberian, or Eur-african, or Mediterranean, there existed an important group of men in the old Stone Age, characterized by the habit of tomb burial, as well as by their short stature and long or oval skull formation. Such remains have been found in Belgium, Denmark, Germany, Britain and France. Now that all "race-characteristics" have been called into question by the most eminent anthropologists, it seems hazardous to make the swarthy Welshman, the small Highlander, the Breton peasant, or any of the "black Celts" descendants of this supposed "race" called Iberian. J. BA.

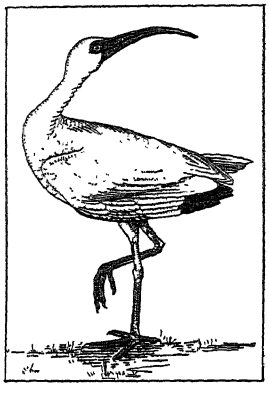
BIBLIOGRAPHY.—Franz Boas, *Anthropology and Modern Life,* 1928.

IBEX, a typical wild goat (genus *Capra*), several species of which are distributed along the mountain

ranges from Spain to China. The males have great horns, which sweep backward in a handsome curve almost to the haunches, and their front surfaces are marked by bold transverse ridges. Ibexes spend their lives near the summit snows and are very wary, severely taxing a hunter's skill.

IBIS, the common name for a family (*Ibididæ*) of wading birds allied to the storks and spoonbills. There are about 30 species widely distributed in warm regions, four of which occur in North America. They are medium-sized or large birds, often brilliantly colored, with long curlew-like bills and stout legs. Ibises feed chiefly upon small aquatic animals and nest in trees, low bushes, among reeds or rarely in holes in cliffs.

The sacred ibis (*Ibis æthiopica*) of Africa, most common in the region of the Upper Nile, is a handsome bird about 2 ft. long. In color it is white throughout except for its black head and feet and several ornamental black plumes on the back. The Egyptians revered this bird as the emblem of Thoth, the secretary of Oriris, often placing its mumified remains with their dead.



WHITE IBIS

The American species, which are all more or less rare in the southern United States, include the magnificent scarlet ibis (*Guara rubra*), vivid scarlet throughout except for black on the wing tips; the white ibis (*G. alba*), of a pure uniform white with black wing markings; the glossy ibis (*Plegadis falcinellus*), with chestnut plumage, and the white-faced glossy ibis (*P. guarauna*). The wood ibis (*Mycteria americana*) belongs to the stork family. A. B. J.

IBLIS, the personal name by which the Moslem designates the Devil. The word is probably from the Greek *diabolos,* whence our word diabolical, although there may be back of it an Arabic root, *balasa,* used of one who can expect nothing from Allah. Iblis is referred to in the Koran, where he is either the chief of the evil *jinn,* or a rebellious angel whom Allah expelled at last from Paradise. Having fallen from heaven, the devil is thereafter called Satan, or *shaitan.* He leads men astray, but in the end will be thrown into hell-fire with all the damned.

IBN EZRA, ABRAHAM (1092-1167), known also as Aben Ezra and Abenezra, famous Jewish poet, astronomer, author and Biblical exegete, was born at Toledo, Spain, in 1092. Isaac, one of his sons, became a convert to Mohammedanism. In 1140, due to poverty, Ibn Ezra left Toledo and traveled through Southern France, Italy, Palestine, Babylonia and Egypt. Later he settled at Rome for several years, as well as in other cities of Italy. At a late period in his life he settled in London. Thus during the entire latter part of his life, Ibn Ezra's career was a solitary, unsettled wanderer's life, with the exception of the few years which he spent at Rome, London, and one or two other great cities. He died in 1167.

Ibn Ezra's greatest renown was achieved in the field of Biblical exegesis. He wrote commentaries on all the entire Hebrew Bible. Those on the Pentateuch were especially important and popular; they were characterized by a strictly grammatical and rational method of interpretation, by vast erudition, and by an intense desire to penetrate to the literal meaning of the Biblical text. They became very popular among the Jewish masses. So important was his commentary on the Pentateuch that many supercommentaries were written on it. A. Sh.

See Graetz, *History of the Jews,* 1926.

IBN GABIROL, SOLOMON (c. 1021-58), renowned Hebrew poet and philosopher, was born at Malaga, Spain, about 1021, and died at Valencia, Spain, about 1058. The details of his life still remain an unsolved mystery. All that is known is that he became an orphan at an early age, and that Jekuthiel ibn Hasan, whose death he later mourned in a superb elegy, was his patron for some years. A legend, which was told also about Judah Halevi and can hardly be taken seriously, states that he was killed at Valencia in 1070 by a Moslem poet who was jealous of his ability. When the Moslem had buried his body under a fig-tree, the tree bore such wonderful fruit that the people of Valencia, in amazement, dug down and discovered Ibn Gabirol's bones.

Ibn Gabirol's great philosophical work was the *Mekor Hayim,* or *Fountain of Life,* which was written originally in Arabic. For hundreds of years, by some strange trick of fate, it was ascribed to a different philosopher. When it was translated from the original Arabic into Latin about 1150, his name was in some way garbled into Avencebrol or Avicebron, and it was assumed that the book was the work of some otherwise unknown Arabian or Christian philosopher. About 1840, however, Solomon Munk definitely established Ibn Gabirol's authorship of the Latin *Fons Vitae,* through the discovery of the Hebrew resumé of the work composed by Shemtob ibn Falaquera.

Ibn Gabirol wrote two other works in Arabic, *Choice of Pearls,* a collection of sayings, and *The Book of the Moral Improvement of the Soul.* Both were translated into Hebrew by Judah ibn Tibbon, and were very popular during his lifetime. An English translation of the latter was published together with the original text by Stephen S. Wise in 1901. A. Sh.

BIBLIOGRAPHY.—Solomon Munk, *Mélanges de Philosophie Juive et Arabe,* 1859; Jakob Guttmann, *Philosophie des Salomo ibn Gabirol,* 1889; Husik, *A History of Medieval Jewish Philosophy,* 1916, pp. 59-79 and index; Graetz, *History of the Jews,* 1926.

IBN JANAH, ABU AL-WALID MERWAN (c. 990-?), called also Rabbi Marinus, the most eminent Hebrew philologist of the Middle Ages, was born in Cordova between 985 and 990. His Hebrew

name was Jonah. He left his native city in 1012 and, after some wandering, settled in Saragossa, where he died in the first half of the 11th century.

Ibn Janah was well acquainted with the Arabic language and literature and wrote a graceful Arabic, in which language he composed all his scientific works. He must have also known Latin, as he quotes the Vulgate. While he based his philological work on his immediate predecessor Hayyuj, whom he greatly revered, he did not refrain from judicious criticism of the latter's theories. By these criticisms and his own elaborations he completed that which was begun by Hayyuj. But these criticisms involved him in a bitter literary war with Samuel ibn Nagdela and other pupils of Hayyuj. The polemic writings on both sides have not come down to us, but their substance is contained in Ibn Janah's preserved works.

His chief work is the *Kitab al-Tanqih,* in two parts. The first was the grammar, *Kitab al-Luma;* the second, a dictionary, *Kitab al-Usul.* The dictionary contains numerous comparisons with the sister languages and a large number of Bible-exegetical details. This work influenced the entire later Hebrew lexicography.

In the exegetical remarks scattered among his works Ibn Janah treats the Biblical text as one would treat an Arabic poem. He draws largely upon rhetoric, and regards Biblical expressions as tropes and metaphors. He assumes transpositions and interchange of letters; and many textual difficulties he clears away hermeneutically. He does not hesitate to contradict tradition, if the natural sense requires it.

IBN TIBBON FAMILY, a family of Jewish translators who lived mostly in southern France in the 12th and 13th centuries. In translating Jewish and Moslem philosophical and scientific works from Arabic into Hebrew, they enriched the Hebrew language with Arabic terms and expressions, and brought Oriental and Hellenic-Oriental thought to the door of the Occident where many Hebrew translations were in turn translated into Latin. The more important members of the family were:

Judah ben Samuel Ibn Tibbon (1120-90), called "the father of translators," physician, translator of Bahya's *Al-Hidayah ila Faraid al Kulub* under the title *Hobot ha-Lebabot,* Judah ha-levi's *Kitab al-Hujjah* under the title *Kuzari,* Saadya's *Kitab al-Amanat wal-I'tikadat* under the title *Emunot we-Deot.*

Samuel Ibn Tibbon (1150-1230), the son of the just mentioned Judah; physician; author of philosophical treatises in Hebrew; translator of Maimonides's great philosophical work *Dalalat al-Hairin* under the title *Moreh Nebukim* or *Guide of the Perplexed.*

Moses Ibn Tibbon (c. 1230-83), the son of the just mentioned Samuel; physician; author of philosophical and exegetic works; translator of those Arabic works of Maimonides not translated by his father.

Jacob ben Machir Ibn Tibbon (1236-1304), grandson of Samuel Ibn Tibbon; physician and regent of the faculty of medicine in Montpellier; astronomer and author of a work on the quadrant and a work containing astronomical tables, both works later being translated into Latin and quoted by Copernicus, Reinhold and Clavius; translator of Arabic adaptations of works of Euclid, Ptolemy and Aristotle. I. E.

BIBLIOGRAPHY.—Steinschneider, *Hebraische Uebersetzungen;* idem, *Jewish Literature;* Gratz, *Geschichte der Juden,* vol. 7; Efros, *Philosophical Terms in the Moreh Nebukim.*

IBSEN, HENRIK JOHAN (1828-1906), Norwegian dramatist, was born at Skien, Mar. 20, 1828. At 16 he found employment in an apothecary shop at Grimstad. His leisure time was devoted to preparing himself to enter the university and to writing verse, for which he gained some local fame. The reading of Sallust inspired him to write a three-act drama, *Catilina,* which is notable chiefly because it was his first attempt in what was to be his life work. A friend advanced the money necessary for publishing the play in book form, but only a few copies were sold. Ibsen entered the University at Oslo (Christiania) in 1850, and in the following year was selected by Ole Bull, the violinist, to be stage director in the newly established theater at Bergen. Before entering upon his duties he spent a year in Denmark and Germany studying the theater. In 1857, after his work in Bergen had begun to attract attention, he was called to Oslo, where he became director of the Norwegian Theater. Later he occupied a similar position at the Christiania Theater. After 1864 he spent most of his time abroad. His early dramas were chiefly historical, as *Lady Inger of Ostrat, The Warriors of Helgeland, The Pretenders.* His European fame began with *The Pillars of Society,* published 1877, a modern play in which he attacked social hypocrisy. His next play, *A Doll's House,* attracted still more attention and provoked discussion wherever it was produced or read. When *Ghosts* was produced a perfect storm of criticism broke over the author's head. The play was denounced as revolutionary and subversive to public morals. Ibsen's next play, *An Enemy of the People,* has been regarded as his reply to his critics. His later plays are *The Wild Duck, Rosmersholm, The Lady from the Sea, Hedda Gabler, The Master Builder, Little Eyolf, John Gabriel Borkman* and finally *When We Dead Awaken,* which Ibsen described as an epilogue to his literary work. Among his poetic dramas, the best known is PEER GYNT. Because of his sure craftsmanship, his brilliant technique, his keen analysis of human character and human emotions, and, most of all, because of his boldness in breaking away from accepted traditions, Ibsen has had a profoundly stimulating effect on the modern drama. His work is known wherever there are theaters and wherever books are read. He died at Oslo, May 28, 1906. *See also* DANO-NORWEGIAN LITERATURE.

BIBLIOGRAPHY.—G. Brandes, *Ibsen and Björnson,* 1899; Sir E. Gosse, *Henrik Ibsen,* 1908; G. B. Shaw, *The Quintessence of Ibsenism,* new ed. 1915; A. E. Zucker, *Ibsen the Master Builder,* 1929.

IBYCUS (6th century B.C.), Greek lyric poet, was born at Rhegium, Italy, about 540 B.C. He spent many years at Samos at the court of Polycrates. He wrote

seven books of lyrics of which fragments remain. Ibycus is supposed to have been murdered at sea, and, according to Plutarch's account, he called the cranes that were following the ship to avenge his death. The murderer long afterwards being at a theater in Corinth saw cranes flying over him and called out, "Behold the avengers of Ibycus," thus revealing himself as the criminal. From this came the expression "the cranes of Ibycus," signifying divine revelation of crime.

ICA, a town of Peru and capital of the department of Ica, situated 46 mi. southeast of Pisco, its port, and 200 mi. southeast of Lima. It is connected with Pisco by railroad, and is the center of a cotton- and grape-producing district. Its chief industry is the manufacture of wine. Although practically destroyed twice by earthquakes, and looted by the Chilean forces, it is an attractive town. Est. pop., 1927, 25,000.

ICARIAN COMMUNITY, a communistic settlement at Nauvoo, Ill., founded by Etienne Cabet, French philosopher. In 1847 Cabet acquired land in Texas for a communistic experiment such as he had described in *Voyages et adventures de lord Carisdall en Icarie,* a utopian romance. An advance contingent reported the climate of Texas as unendurable. Cabet in 1849 established his community of about 300 followers, all French, at Nauvoo, then recently abandoned by the Mormons. Undertaking a diversified scheme of agricultural, manufacturing and trading enterprises, the colony was moderately successful for several years. After dissensions in 1856 Cabet and his immediate followers were expelled, and in 1860, after a period of financial distress, Nauvoo was abandoned. A new settlement was formed in western Iowa by 35 Icarians, which prospered and increased in numbers until 1880, when after another dissension part of the membership established a modified form of the experiment in California. The Iowa settlement was dissolved in 1895.

ICARUS, in Greek mythology, son of DAEDALUS, the sculptor. While living in the island of Crete Daedalus fell under the displeasure of the king, MINOS. In order to escape his wrath the father made wings for himself and his son to fly away, but in their flight Icarus went too near the sun. The wax of his wings melted and he fell into the sea and was drowned. The waters in which he perished have been named for him the Icarian Sea.

ICE, the solid, crystalline form which water assumes when its temperature is maintained at or below 0° C. or 32° F. for any length of time, under atmospheric pressure. It is a clear, colorless solid with a glassy appearance and is quite brittle. Crystallization is in the hexagonal system, and very beautiful crystals are often observable in the frost on window panes and in the form of snow flakes. In addition to its occurrence as snow and frost, ice is also precipitated as hail and sleet, and in colder climates is common as the frozen surface of ponds and lakes. In passing from the liquid to the solid state, or freezing, water exhibits certain anomalous features. Ordinary substances contract when freezing, but water as it is cooled, passes through its maximum density (one gram per cubic centimeter) at 4° C. or 39.2° F. It then expands with lowered temperature and solid ice which forms at 0° C. or 32° F. occupies a larger volume than an equal weight of water, 100 cu. ft. of water making about 109 cu. ft. of ice. Consequently, ice floats, its specific gravity being 0.91. Under pressures of 2,000 atmospheres and more, four other forms of ice are known with densities greater than that of water.

The fact that ordinary ice has a lesser density than water, and consequently floats, is of the greatest importance to the life of the globe. If it sank, then the freezing of lakes and rivers would begin at the bottom, extending gradually upward until the entire body of water was frozen, thus killing all life within it. In arctic and antartic regions even the ocean might be frozen solid. Salt water requires a lower temperature to freeze it than does fresh water however, ordinary sea water solidifying at —2° to —3° C. In the process four-fifths of the salt originally present is rejected. Under actual conditions, ponds and lakes do not ordinarily freeze to the bottom because the crust of ice first formed, being a poor conductor of heat, acts as a blanket to prevent further loss of heat by the water beneath.

The expansion of water on freezing has important geological consequences, since the prying action of water absorbed in the pores of rocks, as it freezes, is a powerful agent of weathering and erosion. Also, where the precipitation of ice as snow or hail exceeds the melting or evaporation, as in mountains and the polar regions, great thicknesses of ice may accumulate in the form of glaciers. When covering large areas, as in Greenland, they are known as ice caps. These masses of ice flow outward from centers of accumulation, or down slopes as though they were viscous. The process is apparently one of shearing along planes in the ice mass, combined with the melting under pressure of the points of contact of the individual granules. The water formed is squeezed to places of lower pressure, where it can freeze again. This phenomenon is also a result of the fact that ice expands on freezing; putting pressure on it hinders the expansion, and a lower temperature is required to overcome the pressure. Thus ice, though brittle, yields in an apparently viscous manner to mild, long continued stresses, as may be easily demonstrated by laying a slab across two supports, when in time it will be observed to sag in the middle.

Glaciers erode and abrade the rock over which they pass, and carry rocks and soils long distances, as described under GLACIATION. Where they enter the ocean the pieces which break off are known as icebergs. In polar regions, the ice that forms on the surface of the ocean is known as floe ice and as pack ice. The somewhat porous ice that freezes to the bottom around the edges of ponds and swamps is called anchor ice.

In passing from water at 0° C. to ice at 0°, 80

calories of heat per gram are given off. Conversely, when ice melts to water at 0° C., 80 calories are absorbed. This is the basis of the use of ice as a refrigerant. Material in the ice-box is kept cold at the expense of the melting ice, and any attempt to save the ice unduly merely defeats the purpose of its employment. A mixture of salt and ice has a lower melting (and freezing) point than ice, liquifying at —18° C. or 0° F. The heat absorbed permits freezing other mixtures, such as those used in making ice cream.

In many places ice is cut from ponds in winter and stored for summer use, but in metropolitan areas artificial or manufactured ice is the common refrigerant. *See also* Ice Age; Ice Manufacture.

S. F. K.

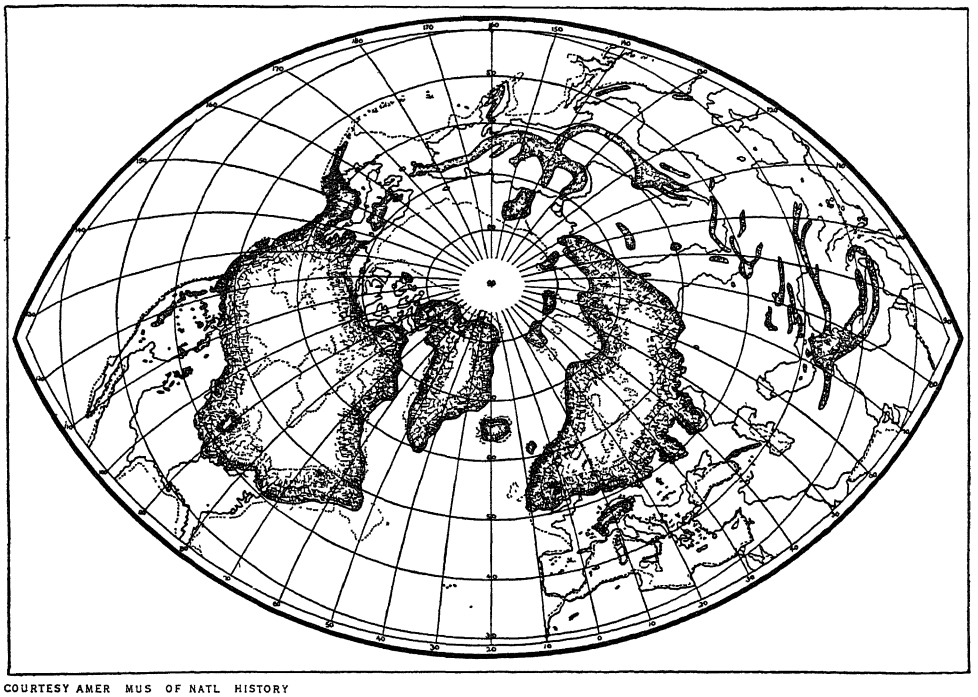
ICE AGE, a time when a mantle of glacial ice covers a land. The most recent such occurrence was in the glacial period of the Pleistocene, when millions of square miles in North America and Europe were covered by several successive sheets of ice. The discovery of ice age deposits, Tillite, in Archeozoic and Proterozoic rocks of Canada, Africa and Australia, refutes the theory that glacial climates were the result of the gradual refrigeration of the earth. Besides these, Cambrian Glaciation has been found in Asia and Australia, Ordovician in America and Europe, and Silurian in Alaska. In the late Carboniferous or early Permian, all the continents except Europe and North America had large ice sheets. Except for Jurassic or Triassic glaciers in Africa, there was little glaciation in the Mesozoic and but little in the Tertiary.

The term Ice Age is frequently used to designate only the periods of Pleistocene glaciation. *See also* Paleozoic; Cenozoic; Geology; Interglacial Stages.

BIBLIOGRAPHY.—A. P. Coleman, *Ice Ages Recent and Ancient,* 1926.

ICEBERG, a towering ice-mass which, breaking from the sea front of a tidal glacier, floats away. Ice blocks are almost constantly crashing down from the rapid moving glacier tongues of Greenland. The disturbance caused by their fall and rocking makes sizeable breakers in the quiet waters of the fiords. Compared with the huge tabular ice-islands discharged by the Antarctic Ice Barrier, some of which are islands miles in extent, and five hundred feet high, Greenland bergs are small. They are, however, important because they drift southward on the Labrador current into the lanes of transatlantic ships. Though they may rise more than 100 to 200 ft. above water, eight-ninths of the ice-mass is submerged. Collision with such a berg caused the loss of the steamship *Titanic* in 1912. Each spring, when the arctic ice-floes begin to break up, the United States Government dispatches a vessel on the hazardous errand of locating and destroying icebergs menacing navigation.

Melting icebergs freshen sea-water, chill the climate of Labrador and Baffin Land, and are a factor in keeping the summers cool in Newfoundland, Nova Scotia, and northern New England. A part of their



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MAXIMUM EXTENT OF AREAS GLACIATED IN THE NORTHERN HEMISPHERE DURING THE PLEISTOCENE EPOCH (Lambert's Equal Area Projection)
Drawing by Chester A Reeds

debris may be dropped as far south as the Banks of Newfoundland.

ICE CAP, a permanent mountain snowfield, or motionless plateau-glacier, from which the moving ice-tongues called valley-glaciers, descend. Some physiographers apply the term "ice-cap" also to the vast expanses of ice covering Antarctica and most of Greenland, and the stupendous ice-sheets which buried northwestern America and northwestern Europe during the ancient glacial period. These are more commonly termed "Continental Glaciers."

Iceland has several small ice-caps and one large one in Vatna Jokull. In Norway, the Jostedalsbrae, covering 350 square miles with a continuous level mantle of ice, neve, and snow, and the smaller Folgefond, form low white domes against which are silhouetted upstanding peaks. The snows of the Folgefond may be traversed by mounted travelers ascending from Sundal on the Hardanger Fjord.

ICE CREAM, a product made by freezing a mixture containing butterfat, milk-solids-not-fat, sugar, usually gelatin, and various flavoring ingredients. Its composition varies, but ordinarily is within the following limits: fat 8-18%, sugar 13-17%, milk solids not fat 6-12%, gelatins 0.25-0.50%; total solids 30-40%.

In the best ice cream the fat and other milk solids are obtained from cream, but in commercial factories where sufficient cream is not always available, unsalted BUTTER is sometimes substituted for part of the fat, and the solids-not-fat may be increased by condensed skimmed milk (*see* MILK PRODUCTS) or skimmed milk powder.

The ingredients are mixed and pasteurized by heating for 30 minutes at about 145° F. and the "mix" is homogenized. The homogenizer is a high pressure pump which forces the mix through a small opening and breaks up and disperses the fat globules. This method produces an ice cream with a smoother texture and prevents the churning of the fat in the freezer. The freezing takes place in a horizontal cylinder surrounded by very cold flowing brine or in some of the more modern freezers by direct expansion ammonia. During the freezing the mix is whipped by dashers to secure very small ice crystals and to incorporate air. When the initial freezing and whipping are finished the mixture is still in a fluid condition and contains sufficient air to increase the volume from 80 to 100%. The half-frozen mixture is drawn into containers and the freezing is completed in hardening rooms, where it is held at temperatures from 5 to 20° below 0° F.

Ice cream is nearly always flavored with vanilla to which may be added coffee, chocolate, maple, and a variety of fruits and nuts. The composition and the physical characteristics of ice cream are varied to make products sold under distinctive trade names. Bisque ice cream contains cake or confections, such as macaroons or marshmallows. Parfait is a rich ice cream, containing egg yolks and sometimes nuts or fruits. A mousse is a frozen whipped cream containing sugar and flavoring matter. The frozen puddings, such as nesselrode, are highly flavored, rich ice cream containing eggs, nuts and fruits. The ices contain no fat and are made with water flavored with fruit juices. They are frozen in the same way as ice creams but there is no incorporation of air. Sherbets are made with skimmed or whole milk and air is incorporated. If they are served in a semi-frozen condition they are called frappes. Punch is an ice highly flavored with rum, wine, or fruit juice or spices. L. A. Ro.

BIBLIOGRAPHY.—G. D. Turnblow and L. A. Raffeto, *Ice Cream.*

ICE CREAM INDUSTRY, UNITED STATES. This industry comprises establishments devoted primarily to the manufacture of ice cream, water ices, sherbets and frozen custards. The recent rapid growth of the industry is shown in the following table:

ICE CREAM MANUFACTURES, U.S., 1914-1929

Year	*No. Establishments*	*Wage Earners*	*Wages $*	*Value of Products $*
1914	2,437	10,376	6,844,615	55,983,133
1919	3,475	19,155	21,698,809	189,483,065
1925	2,790	23,043	33,456,757	286,175,686
1929 ...	3,150	22,399	33,803,044	328,413,911

ICE HOUSES, buildings for storing ice during the summer and used chiefly on farms. Ice houses usually have stud walls, double-sheathed inside and out, the spaces between studs being filled with shavings or sawdust. The ice should be piled in a square on a well-drained floor and insulated with some such material as sawdust, and shavings one ft. thick below the pile, one to two ft. thick around sides and two to three ft. thick on top. The need for ventilation varies with the character of the building. Where artificial drainage is feasible, a hole in the ground may serve the purpose. Where ice is plentiful, the cheapest structure possible is warranted, a large supply being stored to provide for waste.

BIBLIOGRAPHY.—Farmers' Bulletin 1078, *Harvesting and Storing Ice.*

ICELAND, an isolated island in the North Atlantic, situated between 13° 30′ and 24° 32′ W. long., and between 66° 32′ and 63° 24′ N. lat., thus its northern extremity is touched by the Arctic Circle. The area is 39,709 sq. mi., length about 300 mi., and breadth 194 mi. Est. pop. 1929, 106,000. Reykjavik is the capital.

The island has two plateaus, built up by volcanic rocks of older and of newer formation. Two deep bays divide the island into two tablelands connected by an isthmus 4½ mi. across but 750 ft. high. The only tracts of lowland—and there the population is concentrated—are in the west and extreme southwest. The latter district, about 1,550 sq. mi. in extent, is an area of subsidence, gradually sloping from sea level up to a maximum elevation of 400 ft. This is for the most part overgrown with grass on which feed sheep, horses and cows. Fields of lava cover

more than 5,000 sq. mi. of the surface. Overflows of lava are frequent, and within historic times there have been several volcanic eruptions of great magnitude: Mt. Katla in 1721, Mt. Hekla (5,108 ft.), in 1766 and many other occasions down to 1912. Mt. Laki overflowed in 1783, when a fifth of the population and four-fifths of the livestock perished; Askja, the huge crater 25 sq. mi. in extent and 3,000 ft. deep, in 1875, when the pumice which the volcano ejected buried nearly 2,000 sq. mi. in the eastern section of the island. Earthquake shocks have been frequent, and other evidences of continuous volcanic activity exist in the great number of solfataras, pits of boiling mud, and hot alkaline and other springs, or geysers, which are scattered all over the island. Ice also has played an important part in modeling and shaping the contour of the island; the existing ice-fields extend over more than one-eighth of the total surface. The coast is wild, rugged, and much indented by large bays, fjords and small inlets. Polar bears are occasionally seen here during the spring, having drifted ashore on moving ice-floes. White and blue foxes are common in the interior.

Although the distance from Greenland is comparatively short, the difference in climate is great, for a branch of the Gulf Stream, which flows up the south coast and northwards along the west coast of Iceland, does much to counteract the polar currents and temper the climate. The country is therefore not so cold as its name suggests; although the weather is very changeable, especially in the north, where the temperature is considerably lower than in other districts. Here the cold is often severe, owing to the great ice-floes which are frequently carried to this part of the island by the polar current, and which cause occasional spells of cold and foggy weather even during the summer months. On the south coast, in January, the mean temperature is about 34° F., in the northwest corner of the island it is seldom above 20° F. Cattle have to be housed from October to May. The winter is a hard season for the Icelander, who has only a few hours of daylight each day. In summer the longest day is 23 hours, and darkness is unknown.

Of trees there are none in existence except in a few places woods of very stunted birch and here and there small mountain ash and dwarf willow appear. Among food plants, the huckleberry and the crowberry grow wild and are very abundant, and in a few places, wild strawberries are to be found. The edible Iceland moss grows in the mountain highlands. Agricultural products are very scarce, and attempts to grow grain have proved economic failures, but potatoes and turnips are cultivated with success. Considerable progress has been made in animal husbandry, and in 1928 there were 627,000 sheep raised. The fisheries, providing employment for about one-fifth of the population, in 1928 brought in catches estimated at 80,000 tons, principally of cod. Industry is still of little importance in Iceland, but development is possible, as there is a large supply of water power. Lignite coal is found in several places and beds of bituminous have also been discovered. Although no railways yet exist, preliminary surveys have been made.

The Icelanders are of Norse descent. When, toward the middle of the 9th century, Harald Haarfager extended his sway over the whole of Norway, those malcontents who refused to submit to his rule took ship and settled in Iceland. There they found a sprinkling of their own countrymen, who had come directly from Norway after Iceland was accidentally discovered about 870. These two bodies of colonists were supplemented by a third, also of Norse origin, from the Norse kingdom of Dublin and the Western Isles of Scotland. Iceland, however, had been inhabited by a small colony of Irish Culdees before the first Norseman saw it. The island, belonging to Denmark since 1388, became independent in 1918.

ICELANDIC, OLD, the westernmost of the north or Scandinavian group of GERMANIC languages, first known through runic inscriptions of the 4th and 5th centuries A.D., and through a number of words borrowed from it by the languages of the neighboring Finns and Lapps. The Old Norse type was established by incisive changes from about 600 to 800, after which the formation of political groups brought about a division into East Norse (Danish and Swedish) and West Norse (Norwegian and Icelandic). West Norse was spoken not only in Norway, the motherland, but also in her colonies of Iceland, Greenland and the Faroes (where it survives as a distinct language), as well as in portions of the British Isles and Ireland during the Viking period. Old Icelandic extends to about 1540, after which one speaks of New or Modern Icelandic. Among the distinctive features of the old language are the retention of inflectional *-s* as *-r*, postposition of the definite article and formation of a passive voice in *-sk*.

E. Ro.

BIBLIOGRAPHY.—A. Noreen, *Geschichte der nordischen Sprachen,* 3d ed., 1913, and *Altnordische Grammatik,* 4th ed., 1923; A. Heusler, *Altisländisches Elementarbuch,* 2d ed., 1921; A. Jóhannesson, *Grammatik der urnordischen Runeninschriften,* 1923.

ICELANDIC LITERATURE. The year 872, when Harald the Fair-Haired broke the power of the Norwegian chiefs, marked the beginning of Icelandic civilization. Emigrants bringing the West-Norse language and the traditions of the mainland established a culture which for four centuries far outshone that of Norway itself. In Iceland most of the history and legend of the Norse world received literary form. Consequently, Icelandic literature generally includes all West-Norse literary production until the decay which followed the annexation of Iceland by Norway in 1260. Contact with the East-Norse peoples (Swedes and Danes) was relatively unimportant.

Before 1150, vernacular writing in Iceland was rare, but oral composition and recitation were foremost among the arts, and a vast amount of material from the 10th and 11th centuries, and even earlier, was thus available when the Icelandic men of letters

turned their attention to it in the hundred years following 1150. Outstanding in bulk are the sagas, of which over 300 are preserved. The saga was a narrative of any sort: history, legend, fiction, or even translation. The best known are those dealing with the early story of the West-Norse world, where generations of oral transmission blended authentic history with legend. Examples are the *Egilssaga,* a treasure-house of tenth-century history; the *Grettissaga,* a half-legendary story of the hero of northern Iceland; the *Njalssaga,* most popular of Icelandic narratives, and the *Eirikssaga Rautha,* recounting the Greenland settlement and Lief's voyages to America. Norwegian and Icelandic history of the 11th, 12th and 13th centuries is likewise preserved in saga form.

Embedded chiefly in the prose sagas are hundreds of lyric poems forming the body of Skaldic verse. The Skalds were professional or amateur poets, warriors frequently practicing poetry as an avocation. Highly complex verse-forms, utterly obscure diction, and deliberately artificial style deprived most of the Skaldic poetry of enduring literary merit.

Very different were the poems in the collection known as the Poetic or Elder Edda. The word Edda, of doubtful meaning, was applied to two distinct works: a compilation of early Norse poems dealing with the gods and heroes, and a learned prose text-book for poets written in the early 13th century by Snorri Sturluson. The Poetic Edda was compiled in the 12th century, but its component poems are much older. It includes some 37 poems, among them the Norse concept of creation (*Voluspo*), the "Book of Proverbs" (*Hovamol*), the dramatic *Lay of Thrym,* and the cycle built around the originally South-German figure of Sigurd, or Siegfried.

Besides the sagas, the Skaldic poetry and the Eddas, Icelandic literature includes much miscellaneous writing, notably in the field of law. As a whole, it represents the largest and most significant body of material preserved in any one European vernacular from the period between the fall of Rome (410 A.D.) and the 14th century. Five hundred years of virtual stagnation were followed by a marked literary revival during the 19th century, but modern Icelandic literature belongs essentially to the history of Danish culture. H. A. B.

BIBLIOGRAPHY.—W. A. Craigie, *The Icelandic Sagas,* 1913; H. G. Leach, *Scandinavia of the Scandinavians,* 1916; H. A. Bellows, *The Poetic Edda,* American-Scandinavian Foundation, 1923; Halvdan Koht, *The Old Norse Sagas,* American-Scandinavian Foundation, 1931.

ICELAND MOSS, an edible lichen (*Cetraria islandica*) found in arctic and boreal regions. The plant grows in abundance in Iceland and in Norway where it is a minor article of commerce, used to a limited extent for food. It contains lichen-starch and when boiled with milk is nutritious and easily digested.

ICE MANUFACTURE is now standardized to the so-called "raw water" can system using 300 and 400 pounds capacity galvanized iron cans, usually 11 inches by 22 inches by 4 to 5 feet in size and employing electric motor driven AMMONIA compressors. The water used in the cans, which is taken from deep wells or from the city water supply, usually has to be treated with lime or soda ash, or both, in order to remove some of the salts in solution which cause opaque ice. The cans filled with water are lowered into the ice tank which is filled with a non-freezing salt brine held at a temperature of 16 to 18° F. The water in the cans is agitated by means of compressed air. The brine outside the cans also has to be kept in vigorous agitation so that it will absorb heat from the evaporating coils, this agitation being obtained by means of electrically driven propellers. The brine is kept cold by evaporating pipe coils, in which the liquid ammonia vaporizes at a temperature of about 10° F., absorbing heat from the warmer brine. The water takes from 40 to 50 hours to freeze.

According to the Census of 1930 there were in the United States 3,834 ice-making plants, with a total production for 1929 valued at $201,991,545. *See also* COLD STORAGE. H. J. M.

ICE-PLANT (*Mesembryanthemum crystallinum,* or *Cryophytum*), a fleshy creeping annual, one of the fig-marigolds, belonging to the carpet-weed family. It is a native of South Africa, Greece and southern California, widely grown as a window plant and garden ornamental, and sometimes used as a potherb. The much branched, prostrate stem and the very thick leaves are covered with large glistening, dew-like vesicles. In the leaf axils are borne small, short stalked, whitish flowers.

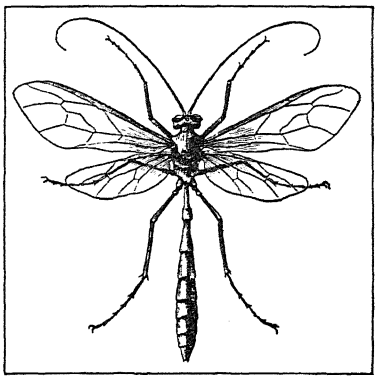
ICHABOD CRANE, a character in Washington Irving's *Legend of Sleepy Hollow.* He is a tall, ungainly schoolmaster with no sense of humor and a great certainty of his own importance.

ICHANG, treaty port of Hupeh province, China, and gateway to the Yangtze Gorges beginning 10 mi. above the city. It is situated on the north bank of the river about 1,000 mi. from the Pacific Ocean and 397 mi. from Hankow. Its chief articles of export are beans, grain, sesamun seed, vegetable tallow and wood oil. Opened to foreign trade in 1876, it was important as a port through which goods passed to and fro from Chungking. The district in which Ichang is situated is scantily populated and is used chiefly for a port where cargoes may be changed from large river steamers to small boats able to travel on the narrower sections of the river. Pop. 1929, 112,309.

ICH DIEN, "I Serve," the motto of the Prince of Wales. According to one tradition, it was derived from the words spoken by Edward I when he presented his son Edward of Carnarvon to the Welsh, "Eich Dyn" (Welsh for "Behold the man"). A second tradition holds that it is the motto of John of Bohemia, killed in the Battle of Crécy, 1346, by the Black Prince, who then appropriated the motto.

ICHNEUMON-FLY, any one of numerous species of wasps of the family *Ichneumonidæ* and related families. Although some are very small, the majority are rather large insects. All are parasitic upon other insects, and are thus very useful to man. They attack

eggs, larvæ, pupæ and even adults of the host species. The majority are internal parasites, but some feed externally. The eggs are laid upon the body of the host. The larvæ of internal parasites bore into the body, feeding at first on blood; later other tissues are attacked. The host insect is not killed at once, but usually dies before attaining maturity. One of the largest of these insects, *Megarhyssa lunator,* with a body sometimes 2 in. in length, is parasitic upon the wood-boring larva of the pigeon horn-tail.



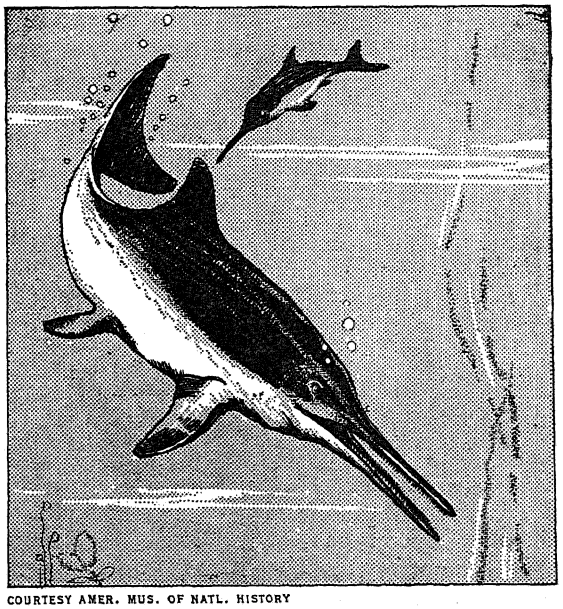
ICHNEUMON-FLY
(Ophion macrurum). Parasitic on the pupae of silkworm moths

ICHTHYORNIS, a genus of primitive sea-birds about the size of large pigeons, discovered by Marsh in 1872 in the Cretaceous sandstones of western Kansas. There their fossil remains were associated with those of another ancient bird, HESPERORNIS. In general aspect they were not unlike modern gulls and terns, except for the disproportionately large head. The structure of the deeply-keeled breastbone, shoulder-girdle, legs and wings, is essentially birdlike; but the slender jaw was armed with small recurved teeth in sockets, and the vertebræ were biconcave, like those of various extinct reptiles and modern fishes. From this latter character they derive their name, meaning "fish-bird." Like modern gulls, these strong-flighted birds were efficient deep-sea fishers. Cleland suggests that *Ichthyornis* must have been forced to carry its prey ashore before devouring it, the curved nature of its teeth precluding the possibility of its bolting captured fish on the wing.

ICHTHYOSAURUS, a primitive air-breathing sea-reptile superficially resembling the modern porpoise, like which it apparently hunted in schools. The Lias beds of England and Germany yield many complete fossilized skeletons, some reaching a length of 30 to 40 ft. The rocks have preserved the "shadow" of fleshed body and limbs, and even the texture of the smooth skin. The body was slender and fishlike without a distinct neck, the tail tapering to a vertical fin. The limbs were reduced to short paddles. The long jaws were armed with sharp recurved teeth sometimes 200 in number, for seizing fish and squids. The enormous eye was in some species the size of a man's head. That they brought forth their young alive is proved by fossil embryos found intact within the skeleton of the mother.

ICON (Greek *eikon*), originally a representation of a human being, later in the restricted sense the conventional Byzantine pictures of Christ and the saints in the churches and homes of Oriental Christians. In the early Church only symbols were used, such as the good shepherd, the fish, the dove, the cross and others, and there was much opposition to the pictures and their veneration. A number of the Byzantine emperors strove to abolish the icons, but in the end the faithful won and the veneration of the holy pictures was permitted. IMAGES, however, were not permitted in the Eastern Church, as they finally were in the Western.

ICONOCLASTS, in modern usage, those who destroy images, pictures and other sacred ecclesiastical objects; by inference, those who destroy without intent to rebuild or replace what they destroy. Specifically and historically, however, the Iconoclasts were a sect or party in the Eastern or Byzantine Empire which opposed all use or honor or worship of icons and images, and destroyed them when they were in power. The movement was instituted by the Emperor Leo the Isaurian by an edict in 726, and afterwards it was aided by Constantine Copronymus, and the later emperors, Leo the Armenian and Theophilus, with whose death in the middle of the 9th century the party became extinct. The Iconoclasts were condemned by the second Council of Nicaea in 787, and final effect was given to its decrees in 842.



COURTESY AMER. MUS. OF NATL. HISTORY
ICHTHYOSAURUS AND YOUNG
From a restoration by Charles R. Knight

IDAHO, one of the northwestern states of the United States, popularly called the "Gem State." It is situated between 42° and 49° N. lat. and 111° and 117° W. long. On the north it is bounded by British

Columbia and Montana, on the east by Montana and Wyoming, on the south by Utah and Nevada, and on the west by Oregon and Washington. Idaho comprises an area of 83,888 sq. mi., including 534 sq. mi. of water surface. In size Idaho ranks twelfth among the states of the Union.



IDAHO STATE SEAL

Surface Features. Mountains cover the greater portion of Idaho. The northern Rockies extend from the northern border three-fourths of the way through the state, and the Wasatch Range with a section of the Great Basin protrudes into southeastern Idaho from Utah. Separating these mountainous areas is a crescent-shaped plains region traversed by the Snake River. These plains form the eastern arm of the Columbia Plateau.

The conspicuous feature of this region is the lack of valleys of sufficient length to subdivide the mountain mass into linear ranges. Divisions into groups is accomplished by the canyons of the Clearwater and Salmon rivers and their tributaries. From north to south the major groups with their average heights are: the Coeur d'Alene, 7,000 ft.; Clearwater, 7,000 ft.; Salmon River, 8,500 ft.; Sawtooth, 9,000 ft. The boundary between Idaho and Montana is defined by the Centennial, Beaverhead and Bitter Root ranges. The latter is generally 9,000 ft. high except for Trappers Peak, 10,175 ft., and terminates with Lolo Pass at the north and Nez Perce Pass at the south.

The Seven Devils Range lies close to the western border next to the Snake River Canyon. This canyon, 125 mi. long and 4,000 to 6,000 ft. deep, is second in grandeur only to the Grand Canyon. Lakes Coeur d'Alene and Pend d'Oreille in far northern Idaho provide some of the most picturesque scenery in the state.

Repeated floods of lava have changed the Snake River plains from a valley to a plain above which protrude island-like mountain masses and scattered cinder cones. In Butte and Blaine counties a cluster of these cones set in a sea of weird lava formations is called Craters of the Moon. The decomposed lava rock furnishes an exceedingly fertile soil for agricultural purposes.

Dominating the plains is the Snake River, a stream of great volume which cuts an arc-like course across the state. It supplies water for irrigation and is an important source of water power. At American Falls its waters descend 50 ft., at Twin Falls, 180 ft. and at Shoshone Falls, 210 ft.

Idaho has a mean elevation of 5,000 ft. above sea level. The highest elevations are Hyndman Peak, 12,078 ft., in the Sawtooth range and Borah Peak, 12,665 ft., in the Salmon River Mountains. The lowest point is 720 ft. in Nez Perce county where the Snake River enters Washington.

Climate. The several regions of Idaho exhibit varied climates. The southern districts are subject to marked extremes, but in the north these are moderated by the "Chinook" wind. At Boise the mean annual temperature is 50.9° F., ranging from a mean of 29.8° F. for January to 72.9° F. for July. In the Upper Snake basin the climate is much colder, dropping to −35° F. During the period 1898 to 1930 the highest temperature recorded in Idaho was 115° F. and the lowest, −50° F. The mean annual precipitation is 18 in., ranging from 8 in. in the more arid part of the Snake River plain to 40 in. in the Bitter Root Mountains. At Boise the average growing season is 168 days.

Forests and Parks. Two types of forest are found in Idaho. The western white pine forests containing also cedar, hemlock, grand fir, and to some extent Douglas fir and lodgepole pine, occur chiefly between 2,000 and 4,500 ft. elevations in the northern section from the Canadian boundary south to the Clearwater preserve. Kaniksu, Pend O'Reille, Coeur d'Alene, St. Joe and Clearwater national forests lie within the zone of this type of forest. Western yellow pine forests requiring a lower annual precipitation, warmer temperature and lower altitude than the white pine forests are located throughout central and southern Idaho and to some extent in the lower altitudes of the northern forests. Many virgin stands of timber remain in Idaho, particularly in the inaccessible mountain regions. Approximately 61.3% of the forest land is owned by the Federal Government and only 9.1% by the state. Nineteen national forests cover 19,317,373 acres. They are open for camping, hunting and fishing and form popular recreation grounds. Extensive game refuges within their boundaries keep the forests well stocked with elk, deer, caribou, mountain sheep and goats and antelopes. A 194,617 acre tract of splendid white pine on Priest Lake and River in northern Idaho is administered as a state forest. Some 136,232 acres of this forest are virgin timber. Idaho has one large state park, the Heyburn State Park, and two reservations, Payette Lake situated in heavily wooded country and Lava Hot Springs containing waters which have been famous for their remarkable curative powers since the days of the Old Oregon Trail. Craters of the Moon, a national monument, and 47 sq. mi. of Yellowstone National Park are in the state.

Minerals and Mining. Idaho possesses valuable mineral resources, the chief of which are gold, including both placer and reef deposits, and ores yielding silver, lead, zinc and copper. From the discovery of gold in 1860 to 1930 it is estimated that the mineral output of the state averaged $15,000,000 annually, or a total of more than a billion dollars for the 70-year period. There have been, however, great fluctuations. In 1914 the total production was about $25,000,000; in 1917 the peak of production during the World War, it amounted to $55,000,000, but in 1921 fell to $16,000,000.

With mineral productions in 1929 amounting to

$32,142,685, Idaho stood twenty-ninth among the states, ranking third in silver, lead and phosphate rock, sixth in zinc and ninth in gold. The principal products in order of value were lead, 148,695 tons, $18,735,538; zinc, 45,675 tons, $6,029,153; silver, 9,414,403 oz., $5,017,877; copper, 5,131,438 lbs, $903,133, and gold, 20,247 oz., $418,545. Among minor products were sand and gravel, clay products, phosphate rock and basalt.

During 1929 65 mines and quarries gave employment to 4,505 persons who received $8,089,125 in salaries and wages.

Soil. In the sagebrush belt of southern Idaho, except where the rainfall is very deficient, the soils are exceptionally fertile as are also the black loams in the valley of the Panhandle section. The soils in the northern part of the state formed by the disintegration of ancient lava flows are especially suitable for the production of durum wheat. In the Snake River Valley the soils covering extensive areas have become highly productive under irrigation.

Agriculture. The leading crop products are wheat, alfalfa, potatoes, fruits and sugar beets.

In 1930 9,346,908 ac. or 17.5% of the entire land area was in farms, 41,674 in number, with an average size per farm of 224.3 ac. and an average value per acre of $44.64. Of the farm area 4,073,265 ac. was crop land; 4,391,801 ac., pasture land; and 123,452 ac., woodland. The total value of farm property was $528,913,948, of which $417,249,572 was represented by land and buildings; $39,748,803, by implements and machinery; and $71,915,573, by domestic animals.

According to the census of 1930 Idaho produced in 1929 field crops to the value of $104,045,287, ranking thirtieth among the states. It stood fourth in sugar beets and plums and prunes, eighth in apples, ninth in potatoes and eleventh in wheat. The chief crops were grains, $48,456,022; hay, 2,332,919 tons, $25,729,970, chiefly alfalfa 1,869,923 tons; potatoes, 14,304,596 bu. grown on 76,609 ac., $17,165,515; fruits, $7,194,401, and sugar beets, 527,257 tons, $3,760,237. The grains included wheat 28,590,857 bu., grown on 1,294,555 ac., barley 4,247,839 bu., and oats 4,244,701 bu. The chief fruits were apples 4,878,937 bu. and plums and prunes 978,264 bu. Farm products sold by cooperative marketing rose from $3,399,598 in 1919 to $7,710,675 in 1929. Farm machinery and equipment in 1930 included 33,966 automobiles, 6,281 motor trucks, 4,691 tractors, 6,713 electric motors and 10,024 stationary gas engines.

Irrigation. Idaho is surpassed only by California and Colorado in the extent and value of irrigated farms and in investments in irrigation enterprises. Irrigation has been developed widely throughout the southern half of the state, about 40 counties being separately reported in the Census of 1930. Nearly all the irrigated areas lie in the extensive drainage basin of the Snake River and its tributaries. About 40% of the crop land is irrigated. Irrigated farms comprised 67% of the number and 69% of the value of all farms in Idaho. The proportion irrigated was 23% of the area of all land in farms and 4% of the land area of the state.

The total number of irrigated farms was 27,953, with an aggregate area of 4,851,440 ac., of which 2,181,250 ac. were irrigated. Including land and buildings the value of all irrigated farms was $289,343,666, or an average of $59.64 per ac. The total investment in irrigation enterprises to 1930 was $84,500,354 and the average cost of maintenance and operation for 1929 was $1.44 per ac.

Animal Industry. Cattle-raising, both for milk and for beef production, and sheep-raising are the chief livestock interests. According to the census of 1930 Idaho stood sixth among the states both in number of sheep on farms and pounds of wool produced, and ranked thirtieth in total value, $71,915,573, of domestic animals on farms. Among the last named were cattle, 622,170, valued at $32,362,214; sheep, 3,301,754, $24,353,514; horses, 206,086, $10,017,009; mules, 7,236, $432,232, and swine, 267,614, $2,968,412.

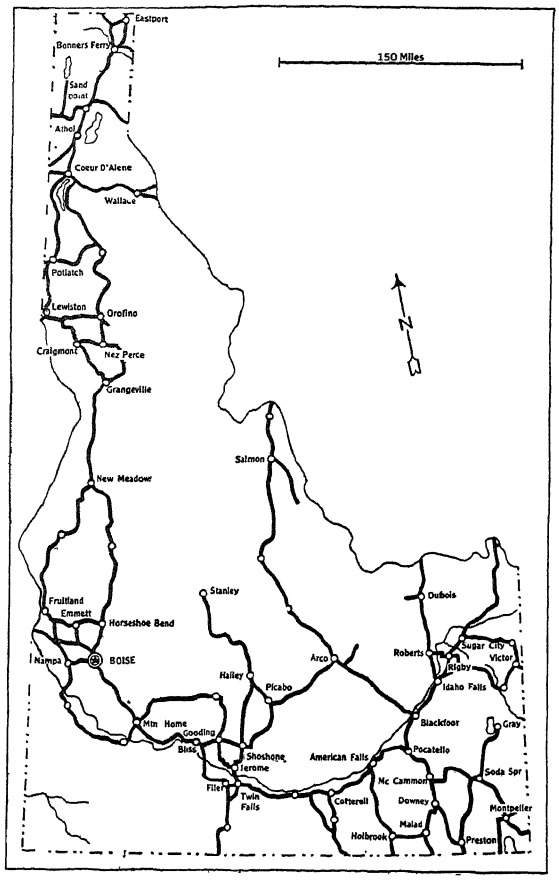
Of the cows on farms, 193,927 were kept mainly for milk production and 121,128 mainly for beef production. In 1929 104,666,773 gals. of milk were produced; the value of dairy products sold was $14,136,256. The wool clip, 18,020,282 lbs., was valued at $5,747,035. The poultry grown, with a value of $4,099,251, included chickens, 3,370,662 in number valued at $2,600,458, and turkeys, 516,976, $1,421,464. Of 16,399,376 doz. chicken eggs produced, valued at $4,569,592, 10,317,682 doz., with a value of $2,871,579, were marketed. Honey, amounting to 2,620,496 lbs. valued at $243,941, was produced from 48,641 hives.

Fisheries. There are no commercial fisheries in Idaho, but the lakes and streams offer some of the finest trout fishing in the country. The state has an up-to-date fish propagation program. In 1930, over $200,000 was received in fees for 93,547 fishing licenses, and of this sum, $70,000 went to the support of 11 state fish hatcheries, employing 14 men. From these hatcheries, 10,000,000 trout and 30,000 other game fish were planted. In accordance with its program of restocking streams in all national forests, the United States Bureau of Fisheries planted millions of fingerlings and yearlings in Idaho waters in 1930. The plantings included 3,019,000 chinook salmon, 300,000 steelhead salmon, 713,700 rainbow trout, 12,000,000 smelt, 8,260 brook trout and 8,000 golden trout.

Transportation. Due to the topography of the region, there are no navigable rivers. The steam railways are the most important factor in the state's transportation facilities. In 1930 the total railway mileage was 2,938. The Oregon Short Line serves the southern part of the state, and has the greatest mileage. The Northern Pacific, Great Northern and Milwaukee systems pass through the northern portion. The Union Pacific system cuts across the extreme southern end of the state.

The highway system, inadequate in the past, is steadily being improved and extended. On Jan. 1,

1930, there were 48,021 mi. of highways, including 8,884 mi. of surfaced roads and 2,484 mi. of state highways. The total highway expenditure during 1929 was $7,822,614, of which $2,979,839 was paid by the state and $4,842,775 by county and local governments. The state gasoline tax produced a gross revenue of $2,730,862 in 1930. Motor vehicle registrations were 119,077 in 1930, compared with 81,506 in 1925, an



IDAHO STATE ROADS

increase of almost 50%. The rapid growth of trucking facilities is attested by a motor truck registration of 14,551 in 1930, approximately double the 7,610 trucks registered in 1925. During the same period the number of buses in operation increased from 477 to 536.

Manufactures. Forest and agricultural resources form the basis of the state's manufacturing industries.

According to the Census of 1930 Idaho with manufactures for 1929 valued at $96,352,026 stood forty-fourth among the states. Its 562 establishments gave employment to 1,375 officers and employees, who received $3,036,272 in salaries, and to 15,648 wage earners, who were paid $22,451,545 in wages. These factories used a total of 105,787 horse power, expended $1,645,797 for fuel and power, and $50,217,708 for materials and supplies, and added by the process of manufacture $44,488,521 to the value of their output.

The chief industry is the manufacture of lumber and timber products. These, with a value of $33,886,402, comprised 35% of the total factory output of the state. Among other important manufactures were butter valued at $11,127,108; flour, $6,889,112; preserved wood products, $3,798,781; steam railway car-shop construction and repairs, $3,559,358; printing and publishing, $2,988,958; meat packing, $2,274,431; bread and bakery products, $2,024,503, and cheese, $1,664,054. The principal manufacturing centers with value of output were Pocatello, $5,726,774, and Boise, $3,200,057.

Commerce. According to the census of 1930, there were in 1929 681 wholesale establishments in Idaho, with total sales of $121,193,295. They employed 3,386 men and women, whose annual salaries aggregated $4,523,524.

The sales of the 4,947 retail stores amounted to $169,471,843. Sales per store averaged $34,257; sales per capita were $380.81.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	*No. of Stores*	*Sales*	*% of Total*
Automotive	1,084	$40,963,535	24.16
General Mdse.	623	37,602,300	22.18
Food	985	29,440,704	17.37
Lumber & Bldg.	355	13,589,486	8.02
Apparel	261	6,884,437	4.06
Furn. & Household	188	6,865,751	4.06
All other stores	1,451	34,125,630	20.15
Total, all stores	4,947	$169,471,843	100.00

Finance and Banking. The assessed value of all real and personal property in Idaho in 1929 was $486,604,395 and the basis of assessment was 50%. Total bonded debt on Jan. 2, 1931 was $5,023,753. Total revenue receipts in 1929 were $8,276,955; chief sources of revenue were property and special taxes, $2,516,208; sales tax on gasoline, $1,699,144 and motor vehicle taxes, other licenses and corporation taxes. Total expenditures in 1929 were $8,613,477, with construction and maintenance of highways, $4,122,287, permanent improvements, $3,301,803, and debt service, $365,465, among the principal items.

There were 135 banks in Idaho in 1930, of which 40 were national banks and 95 trust companies and state banks. Their total capitalization was $5,967,500, with surplus and undivided profits of $4,946,000. Total resources were $100,715,000; aggregate loans and discounts $47,040,000. Demand and time deposits including postal savings totaled $82,432,000. Per capita demand and time deposits were $184.00; per capita savings deposits $69.49. The total savings of $31,132,000 were owned by 69,941 depositors. National bank circulation aggregated $1,423,000.

Government. The legislative power of the state is vested in a senate composed of 44 members and a house of representatives of 65 members, all elected for terms of two years and meeting in biennial sessions limited in duration to 60 days. The executive department consists of the governor, lieutenant governor, attorney-general and superintendent of public instruc-

tion, each elected for terms of two years. The governor receives a salary of $5,000. He has the usual veto power. Judiciary power is vested in a court for the trial of impeachments (the senate), a supreme court, district and probate courts and justices of the peace. The supreme court consists of five judges elected for terms of six years at $5,000 per annum.

Social Welfare Institutions. There is a state school and colony for mental defectives at Nampa and an industrial training school at St. Anthony. At Lava Hot Springs is a state hospital for invalids. Blackfoot and Orofino have state sanitariums for the insane. A soldiers' home is at Boise; the state penitentiary also is here.

Education. The first schools in Idaho developed slowly. By 1866 there were only 14 schools with 436 pupils, and as late as 1873 there was no school in Boise, the capital and largest city. After 1880 the educational development of the state was rapid. By 1928-29 there were 1,469 public elementary schools having 3,162 teachers and 98,260 pupils and 212 high schools with 1,021 teachers and 25,156 pupils. All children between the ages of 8 to 18 years are required to attend school the full school term.

The number of persons, 5 to 20 years of age attending school in 1930 was 114,382, or 75% of the population within the ages specified, as compared to 102,926, or 71.8% in 1920. Persons 10 years and over unable to read and write numbered 3,743, or 1.1%, in 1930; and 4,924, or 1.5%, in 1920.

The state institutions for higher education include the University of Idaho at Moscow and normal schools at Lewiston and Albion. The College of Idaho, a private coeducational institution, is located at Caldwell. The State Library Commission has headquarters in the State House at Boise.

Population. In 1930 Idaho ranked forty-second among the states with a population of 445,032 or an average of 5.3 per square mile, an increase of 13,166 or 3.0% over 1920. The population rose from 14,999 in 1870 to 161,772 in 1900, 325,594 in 1910, and to 431,866 in 1920. In 1930 there were 437,562 whites, 1,278 Mexicans, 3,638 Indians, 1,421 Japanese, and 668 Negroes. Of the whites, 407,108 or 91.5% were native born and 30,454 or 6.8% were foreign born. The rural population was 315,525 or 70.9% of the total, an increase of 2,696 or 0.9% from 1920; the urban population was 129,507 or 29.1% of the total, an increase of 10,470 or 8.8% since 1920. In 1930 the two largest cities were Boise, the capital, 21,544, and Pocatello, 16,471.

Occupations. In 1930 162,232 persons, or 36.5% of the population, were gainful workers 10 years old or older; 86.3% of these were males and 13.7% were females; 87.1% were native white; 11.2% foreign-born white, and 1.5% other races. Among the chief occupations, with number of workers, were agriculture, 65,528; manufacturing, 26,652; trade, 16,641; transportation and communication, 11,523; professional service, 11,417, domestic and personal service, 11,032; mining, 5,577, and forest industries, 5,447.

HISTORY

Idaho was part of the "Oregon country" claimed by Spain, Russia, Great Britain and the United States. Spain relinquished her claim in 1819, Russia hers in 1824, Great Britain and the United States holding the region jointly until 1846, when by treaty with England the United States was given sole possession south of the 49th parallel. It was first visited by white men in 1805-6 when Lewis and Clark led their memorable exploring expedition across the mountains. Three years later Thompson and McDonald, agents of the British North-West Company, built the first trading post in the region at Lake Pend Oreille, and the next spring took out over 4,000 pounds of fur. The second building in Idaho was the trading post started in 1810 by Andrew Henry on Henry's Fork of Snake River, the first built by a United States citizen west of the CONTINENTAL DIVIDE. British traders continued to control the region, however, for 35 years. In 1834 Nathaniel Wyeth, a Bostonian, built Ft. Hall, a trading post on the upper Snake River, and the same year the HUDSON BAY COMPANY built Ft. Boise, both becoming famous stopping places on the OREGON TRAIL. A mission station was established by Rev. and Mrs. Henry Spalding in 1836 east of the present Lewiston, and in 1842 a Catholic mission was started among the Coeur d'Alene Indians. A Mormon colony started in 1855 on the Lemhi River was recalled because of Indian hostility, and the first permanent settlement was not made until 1860 when a group of MORMONS settled at Franklin, began farming and opened the first school for white children. In the same year a rich discovery of gold on Oro Fino Creek initiated a rush to the Idaho country. In 1861 the first county was organized, Shoshone of Washington Territory, gold and silver were found in many localities, and Pierce City, Lewiston, Elk City, Florence and other towns were founded. Idaho Territory, including WYOMING, MONTANA, and parts of NEBRASKA and of NORTH DAKOTA and SOUTH DAKOTA, was organized as a separate territory in 1863, with Lewiston as the first capital. After two years the capital was removed to Boise, where it has since remained. Idaho was admitted to the Union July 3, 1890, its population being 88,548 in that year. The rapid influx of miners and ranchers, and the development of the region led to serious Indian wars. Since 1920 a Republican state nationally, Idaho in 1932 reversed the precedent and gave its four electoral votes to Roosevelt. The Democratic candidate, James P. Pope, won the vacant senatorship. C. Ben Ross, Democrat, was reelected to the governorship.

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IDAHO, UNIVERSITY OF, at Moscow, Ida., a coeducational state institution, established in 1889. It includes the State Agricultural College and Experimental Station, schools and colleges of Letters and Sciences, Agriculture, Engineering, Law, Mines, Forestry, Education and Business Administration and a Graduate School. Idaho had an estimated income in

1931 amounting to $1,308,042. The library contained approximately 101,000 volumes. In 1931 there was a student enrollment of 1,799, and a faculty of 163 headed by Pres. Mervin G. Neale.

IDAHO FALLS, a city in southeastern Idaho, county seat of Bonneville Co., situated on Snake River, 50 mi. northeast of Pocatello. It is served by buses and the Oregon Short Line of the Union Pacific Railroad. Idaho Falls is a busy industrial center for a large irrigated region, producing sugar beets, peas, potatoes and live stock. The city has beet-sugar factories and a seed-cleaning plant which supplies the whole country with bean and pea seeds. There are also grain elevators, warehouses and flour mills. The first bridge across the Snake River was built in 1866. The city was named for the falls at the head of a narrow gorge in the river, although in the early days, when it was a supply station on the Utah-Montana Trail, it had been known as Eagle Rock. Idaho Falls was incorporated in 1900. Pop. 1920, 8,064; 1930, 9,429.

IDEA, a reproductive image; a metaphysical concept; an instrument of knowledge. The first meaning is psychological, the second Platonic and the third logical.

As a reproductive image an idea is not as clear and vivid as a sensation. This was the basis of Hume's (*see* HUME, DAVID) distinction between impressions and ideas. The Platonic Idea is the essence of reality. It is a concept, and concepts are real. They are the source of the world of perception. An idea as an instrument of knowledge is the conception required by logic. Here an idea is a tool for analysis and description. It summarizes and refers to a group of analogous perceptions.

IDEALISM, a philosophy holding that the reality of things is in some sense mental; a theory that perception is either necessary to or modifies the object of knowledge; the reality of ideas. The first sense is metaphysical, the second epistemological, and the third Platonic. Idealism as a philosophy should be distinguished from the popular use of the word as referring to the having of ideals. This is not a philosophic idealism in any sense of the word.

Metaphysical idealism may take various forms, but in any case it holds that the fundamental nature of things is akin to the psychical in character. It is thus opposed to materialism. Idealism would reduce matter to mind. Just what particular attribute is emphasized in this mental something depends upon the one doing the philosophizing. It may be reason, it may be will, it may be morality, it may be purpose, or it may be sentience that is mainly attributed to the ground principle of the universe. In any case it is an attribute of self that is given to the Absolute. If idealism is monistic it is known as absolute idealism and is best represented by the Romanticists, whose goal it was to get in touch with the Absolute. Epistemological idealism may be either subjective or transcendental, the one being expounded by Bishop Berkeley and the other by IMMANUEL KANT. According to Berkeley, the essence of a thing consists in its being perceived; that is, a thing in order to be must be perceived. This is the old story that there is no sound unless there is an ear to hear it and no color unless there is an eye to see it. But Berkeley went further and treated primary qualities by the same principle. Kantian idealism would not make being consist in being known, but it would make knowledge constitutive of its object, that is, determine it by its own forms. The understanding, by its categories, gives form to knowledge, and in so doing reality in itself becomes unknowable. Since knowledge consists of appearances, this doctrine is otherwise known as phenomenalistic idealism.

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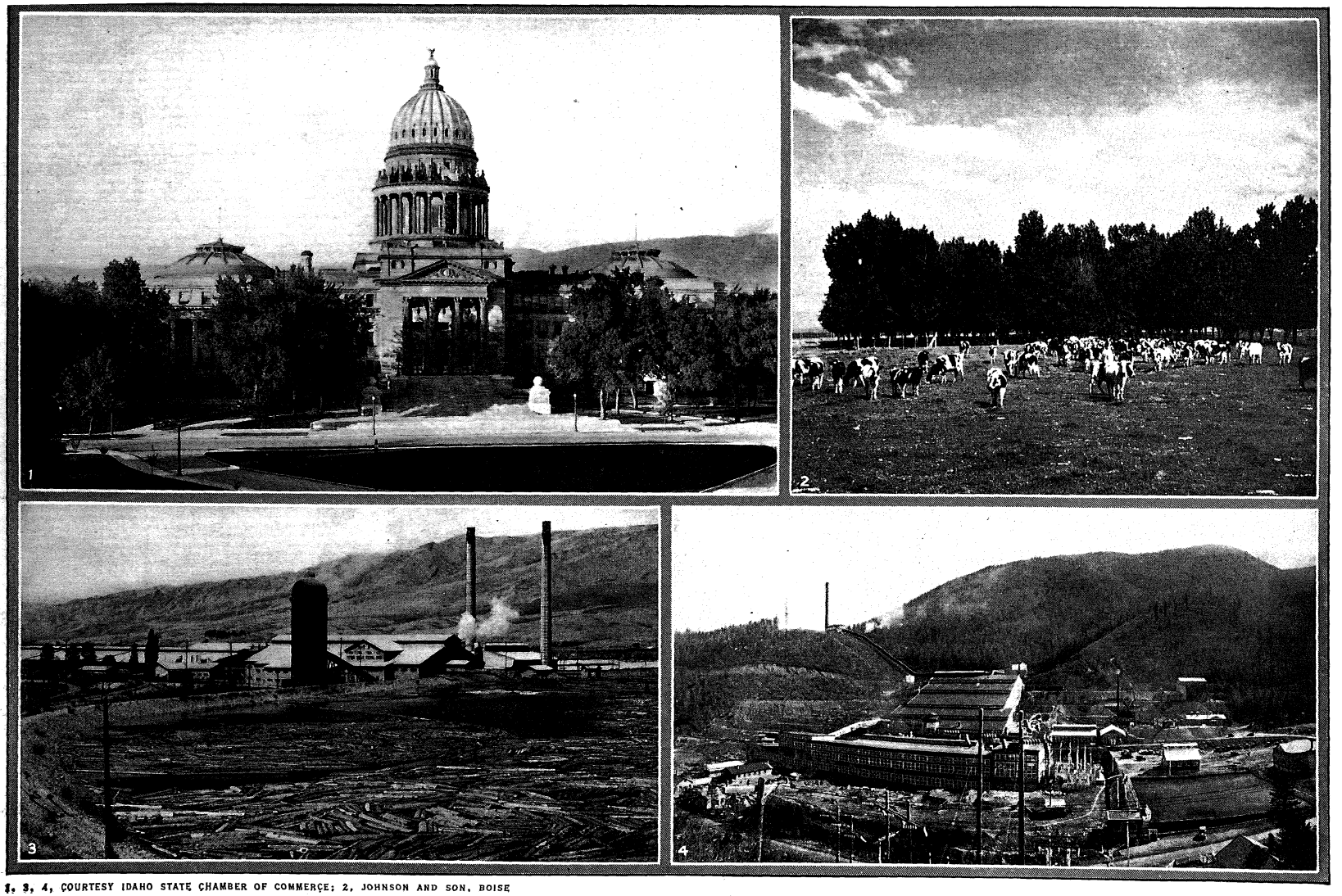
IDEOGRAM, an inscribed or written symbol ("heaven," "earth," etc.) representing an object or idea without expressing name or sound. In the history of writing it takes an intermediate place between the PICTOGRAPH from which it developed, and the syllabic script for which it formed a basis. In CUNEIFORM writing the ideogram is also used as a determinative placed before or after a noun to indicate a proper name, gender, or quality.

IDEOLOGY, a system explaining the nature of ideas. The word comes from Destutt de Tracy (1754-1830), the leader of the ideologists. The main tenet of the school is that all ideas are derived from sensation. The extreme sensationalism of Condillac was taken up and developed into an ideology. Cabanis, a contemporary of de Tracy, was the other most important representative of the school. The movement found its best expression in France.

IDIOCY. *See* FEEBLE-MINDEDNESS.

IDIOM, a phrase or construction peculiar to a certain language or group of languages. Often apparently meaningless, an idiom almost invariably becomes wholly rational and explicable when its historical development is known. Thus the French idioms, *il y a,* "it is, there are" (cf. Old French *n'at tant bel chevalier,* "there is not so fair a knight") and *il fait chaud,* "it is hot," find their origins in VULGAR LATIN phrases, as *in arca Noe habuit homines,* "there were men in Noah's ark," *habebat ibi silvam,* "there was a forest," *numquam fecit tale frigus,* "it was never so cold," *habuit, fecit,* etc., here being impersonal, i.e., "one had," "one made" ("passed through"). Similarly, French *on dit*=German *man sagt,* "one says, it is said," apparently have their true origin in such Vulgate phrases as *homo dicit* "(a) man says," which may in turn be based upon equivalent phraseology in the HEBREW text of the Old-Testament.

IDIOSYNCRASY, a trait peculiar to an individual. It is a constitutional or temperamental peculiarity and may be either physical or mental in its manifestation. Most common among idiosyncrasies are those of manner and taste. The peculiar likes and dislikes of an individual or any peculiar mannerisms he may pos-



1, 3, 4, COURTESY IDAHO STATE CHAMBER OF COMMERCE; 2, JOHNSON AND SON, BOISE

DIVERSIFIED VIEWS IN THE STATE OF IDAHO

1. The State Capitol at Boise. **2.** Holstein dairy herd of the Idaho state school and colony at Nampa. **3.** Lumber mill at Lewiston. **4.** Zinc plant and mine at Kellogg; Bunker Hill in background.

IDAHO

Area 83,888 sq. m.
Pop. 445,032

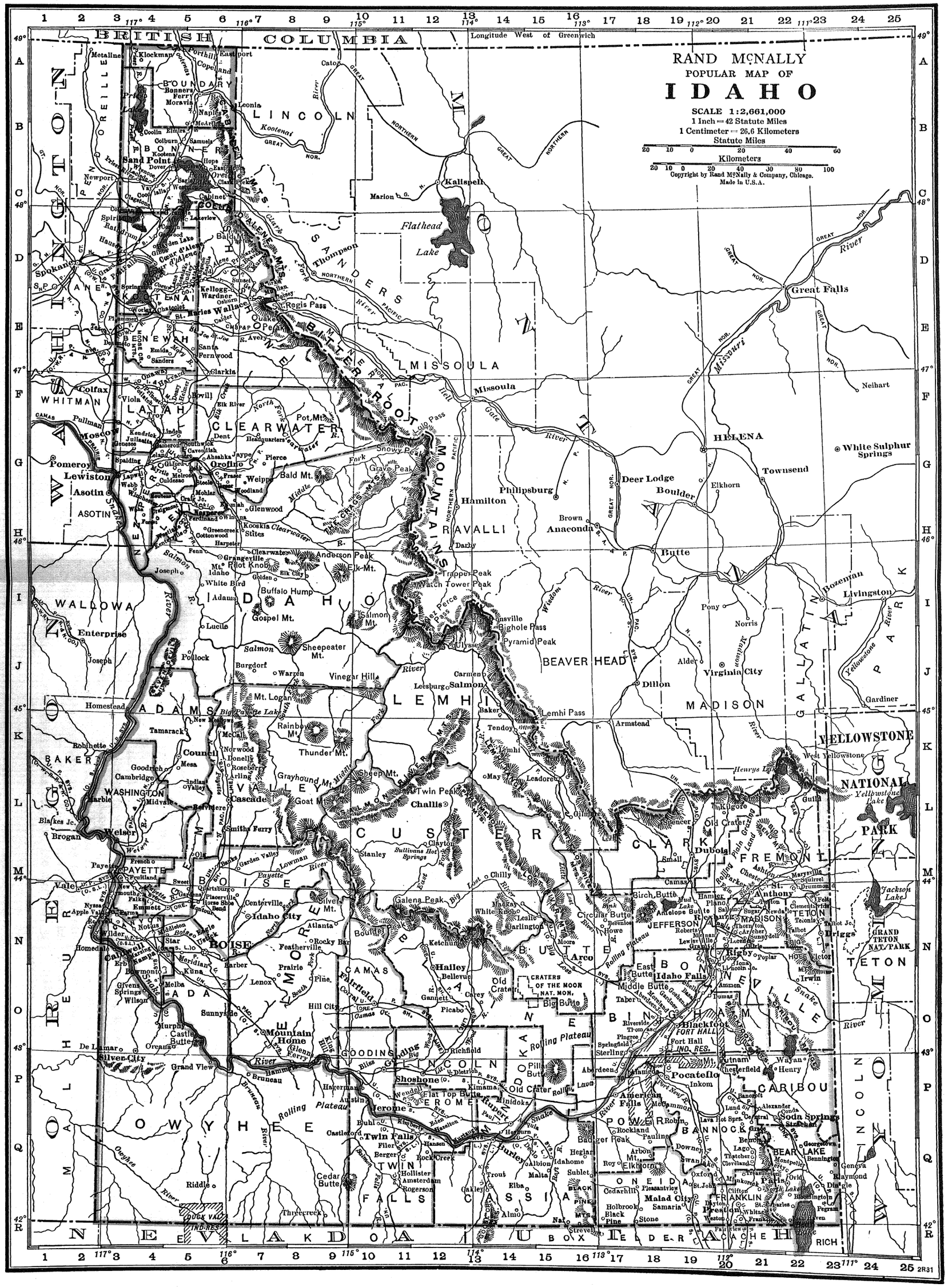
PRINCIPAL CITIES

Pop.—Thousands

2 Alameda . . P 19
1 American Falls . . P 17
1 Ashton . . M 21
3 Blackfoot . . O 19
22 Boise . . . N 6
1 Bonners Ferry . . A 5
2 Buhl . . . Q 10
4 Burley . . . Q 14
5 Caldwell . . N 3
8 Coeur d'Alene . . D 4
3 Emmett . . . M 4
1 Filer . . . Q 11
1 Glenns Ferry . . P 8
2 Gooding . . . P 11
1 Grangeville . . H 6
1 Hailey . . . N 12
9 Idaho Falls . . O 20
2 Jerome . . . P 11
4 Kellogg . . . D 6
9 Lewiston . . . G 3
3 Malad . . . R 18
1 Meridian . . . N 5
2 Montpelier . . Q 22
4 Moscow . . . F 13
1 Mountain Home . . O 8
2 Mullan . . . E 7
8 Nampa . . . N 4
1 Orofino . . . G 6
3 Payette . . . M 3
16 Pocatello . . P 19
3 Preston . . . R 20
1 Priest River . . A 3
2 Rexburg . . . M 20
3 Rigby . . . N 20
2 Rupert . . . P 13
3 St. Anthony . . M 22
2 St. Maries . . E 5
1 Salmon . . . J 13
3 Sandpoint . . B 4
1 Shelley . . . O 19
1 Shoshone . . P 11
1 Spirit Lake . . C 3
1 Twin Falls . . Q 11
9 Wallace . . . E 6
4 Weiser . . . L 3

Pop.—Hundreds

6 Aberdeen . . P 17
6 Arco . . . . N 16
7 Barber . . . N 6
6 Bovill . . . F 5
6 Bowmont . . N 5
6 Bruneau . . L 6
5 Cascade . . . L 6
5 Cottonwood . . H 5
5 Craigmont . . H 4
5 Downey . . . Q 19
7 Driggs . . . N 23
6 Elk River . . F 6
6 Franklin . . R 21
6 Genesee . . . G 3
6 Grace . . . . Q 20
5 Harrison . . . D 3
6 Kamiah . . . H 6
6 Kimberly . . Q 11
5 Lamberly . . Q 11
5 Malad City . . R 18
6 Malta . . . Q 16
5 McCammon . . P 19
7 McCall . . . K 6
5 McCammon . . P 19
8 Mackay . . . M 14
4 Menan . . . N 20
4 Middleton . . N 4
5 New Plymouth . . M 3
4 Nezperce . . H 6
4 Oakley . . . Q 13
8 Paris . . . . Q 21
8 Parma . . . . N 3
4 Paul . . . . Q 13
5 Post Falls . . D 3
5 Rathdrum . . D 3
4 Rockland . . Q 17
5 St. Charles . . Q 22
5 St. John . . . Q 22
7 Salem . . . M 20
8 Soda Springs . . Q 21
4 Star . . . . N 3
6 Sugar . . . . N 21
5 Teluse . . . D 7
6 Troy . . . . N 21
4 Ucon . . . . N 20
9 Wardner . . . E 6
7 Wendel . . . P 11
4 Weston . . . R 20
4 Wilder . . . N 3
7 Winchester . . H 4


RAND McNALLY
POPULAR MAP OF
IDAHO
SCALE 1:2,661,000
1 Inch = 42 Statute Miles
1 Centimeter = 26.6 Kilometers
Statute Miles
Kilometers
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Made in U.S.A.
Longitude West of Greenwich
BRITISH COLUMBIA
MONTANA
WASHINGTON
OREGON
NEVADA
UTAH
WYOMING
BOUNDARY
BONNER
KOOTENAI
SHOSHONE
BENEWAH
LATAH
CLEARWATER
NEZ PERCE
LINCOLN
SANDERS
MISSOULA
LEWIS AND CLARK
POWELL
IDAHO
WHITMAN
ADAMS
WASHINGTON
PAYETTE
BOISE
GEM
ADA
CANYON
OWYHEE
ELMORE
VALLEY
CUSTER
LEMHI
BLAINE
CAMAS
GOODING
JEROME
TWIN FALLS
CASSIA
MINIDOKA
BEAVER HEAD
DEER LODGE
GRANITE
RAVALLI
MADISON
GALLATIN
PARK
YELLOWSTONE NATIONAL PARK
BUTTE
CLARK
FREMONT
JEFFERSON
TETON
BONNEVILLE
JEFFERSON
MADISON
BINGHAM
CARIBOU
POWER
BANNOCK
ONEIDA
FRANKLIN
BEAR LAKE
BOX ELDER
CACHE
RICH
Kootenai River
Clark's Fork
Flathead Lake
Thompson River
Missouri River
Snake River
Salmon River
Clearwater River
Bitterroot Mts.
Coeur d'Alene Mts.
Cabinet Mts.
Selkirk Mts.
Salmon River Mts.
Lost River Range
Lemhi Range
Pioneer Mts.
Beaverhead Mts.
Centennial Mts.
Big Hole Mts.
Sawtooth Mts.
Boulder Mts.
Albion Mts.
Bear River Range
Wasatch Mts.
Teton Range
Snake River Plain
Rolling Plateau
Craters of the Moon Nat. Mon.
Yellowstone Lake
Jackson Lake
Grand Teton Nat. Park
Missoula
Kalispell
Great Falls
Helena
Butte
Bozeman
Livingston
Lewiston
Moscow
Pullman
Colfax
Boise
Nampa
Caldwell
Idaho City
Hailey
Ketchum
Sun Valley
Twin Falls
Jerome
Rupert
Burley
Pocatello
Blackfoot
Idaho Falls
Rexburg
St. Anthony
Driggs
Victor
Teton
Dillon
Virginia City
Anaconda
Philipsburg
Hamilton
Deer Lodge
Boulder
Townsend
White Sulphur Springs
Neihart
Gardiner
Cooke City
Red Lodge
Billings
Missoula
Coeur d'Alene
Sandpoint
Priest River
Bonners Ferry
Wallace
Kellogg
Mullan
Grangeville
Lewiston
Orofino
Salmon
Challis
Stanley
Sun Valley
Ketchum
Hailey
Bellevue
Gooding
Shoshone
Rupert
Burley
Malta
Albion
Oakley
Almo
Malad City
Preston
Soda Springs
Montpelier
Paris
Bear Lake
Grand Teton
Yellowstone
Gallatin
Madison
Beaverhead
Big Hole
Bitterroot
Flathead
Kootenai
Pend Oreille
Priest
Selkirk
Cabinet
Coeur d'Alene
St. Joe
Clearwater
Salmon
Sawtooth
Boulder
Albion
Wasatch
Bear River
Teton
Snake
Missouri

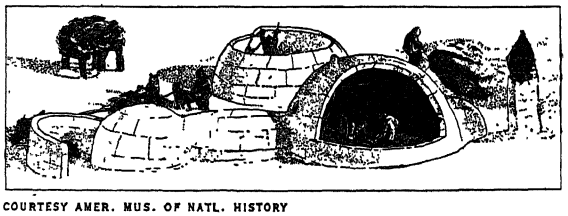
sess are some of his idiosyncrasies. A person who likes static but who is nauseated by the sight of candy might be said to have idiosyncrasies at these points. One who has a queer accent may have an idiosyncrasy of speech: one who holds his hand in some strange position, or dresses in an outlandish fashion, may be displaying idiosyncrasies. Any queer, strange or novel expression of behavior, insufficient in degree to be termed abnormal, is idiocratic.

IDYL or **IDYLL,** a short poem describing scenes and events of rural or pastoral life. The term, which means "a little picture," came into use with the invention of the pastoral poem by the Alexandrian School in the 3rd century B.C., specifically with the compositions of THEOCRITUS, Moschus and Bion. It did not originally denote a particular verse form, and of Theocritus's 31 "idyls" only ten are strictly pastoral in character. The idyl was used in a much modified form by Tennyson, who called his poem IDYLLS OF THE KING, and in the French by Victor de Laprade's so-called *Idylles héroïques,* 1858. In music it means a sentimental or pastoral composition.

IDYLLS OF THE KING, a series of narrative poems by ALFRED TENNYSON, published 1859-85, dealing with the Arthurian romances, based partly on Malory's MORTE D'ARTHUR. It was the poet's intention that each of these idylls should present some aspect of the strife between Sense and Spirit, and that, taken together, they should form an allegory of the life of man. The idylls are entitled: The Coming of Arthur; Gareth and Lynette; Marriage of Geraint; Geraint and Enid; Balin and Balan; Merlin and Vivien; Lancelot and Elaine; The Holy Grail; Pelleas and Ettarre; The Last Tournament; Guinevere; The Passing of Arthur.

IGLAU. *See* JIHLAVA.

IGLOO or **IGLU,** a name popularly applied to the Eskimo snowhouse. It is derived from the Eastern Eskimo term for snowhouse, *igdlu.*



COURTESY AMER. MUS. OF NATL. HISTORY

MODEL OF AN ESKIMO WINTER HOUSE OR IGLOO, ON CUMBERLAND SOUND

The house in the foreground has been cut away to show the interior

IGNATIEV, NICOLAI PAVLOVOCH, COUNT (1832-1908), Russian diplomat, was born at St. Petersburg, Jan. 1832. He negotiated with China the treaty of Aigun in 1858, which secured for Russia the region of the Amur. Ignatiev subsequently was sent as envoy to Khiva and Bokhara, then to Peking, and later as ambassador to Constantinople. At the close of the Russo-Turkish War he arranged the Treaty of San Stefano. He died July 3, 1908.

IGNATIUS LOYOLA. *See* LOYOLA, ST. IGNATIUS.

IGNEOUS ROCKS, the great group of rocks, forming most of the earth's crust, which have solidified from molten masses (*see* MAGMA) derived from the heated interior, or ASTHENOSPHERE, of the globe. They are the ultimate source of practically all the materials upon the surface of the earth, including the SEDIMENTARY ROCKS which are themselves a product of the WEATHERING and EROSION of preexisting rocks. Through these processes which break down the igneous rocks, the mineral substances they contain are made available for the use of the organic world. The group includes such rocks as GRANITE, DIORITE, GABBRO, and the lavas; its study is included in the science of PETROLOGY. *See also* VULCANISM; METAMORPHIC ROCKS.

IGNIS FATUUS. *See* WILL-O'-THE-WISP.

IGUANA, a name correctly applicable only to lizards of the large family *Iguanidæ.* These lizards, which exhibit great diversity in form and size, are widely distributed in the New World. Three genera are found in the Old World, *Brachylophus* in the Fiji and Friendly Islands, and *Hoplurus* and *Chalarodon* in Madagascar. One of the best known species is the common iguana (*Iguana iguana*), found from Central America through tropical South America. This handsome green reptile attains a length of 5 ft. and has a conspicuous comb-like crest down the middle of its back. It is largely herbivorous and arboreal and swims with ease. Its flesh is esteemed as a great delicacy. Other striking forms are the marine iguana of the Galapagos Islands (*Amblyrhynchus cristatus*), the crested basilisks of tropical America (*Basiliscus*) and *Deiroptyx* of Cuba. This last named lizard has the rare ability of actually running over the surface of water.



COURTESY N.Y. ZOOLOGICAL SOCIETY

IGUANA

IGUANODON, a bulky, plant-feeding dinosaur, of semi-aquatic habit, which haunted the marshlands of England, Belgium and other parts of Europe during late Jurassic and early Cretaceous times. This reptile, named from the likeness of its teeth to those of the South American lizard, iguana, reached a length, including the tail, of 30 ft. Fossil footprints indicate that it walked on its 3-toed, hoofed hind feet, when it must have stood full 15 ft. high, and that in resting it used its tail as a kangaroo does to form a supporting tripod. The elongated head was bent down for cropping vegetation, the jaw, armed only toward the back with shearing teeth, being protected by a horny beak, like a turtle's.

IGUVIUM, also Euguvium or Eugubium, the modern Gubbio, an ancient city of Umbria on the

southern slope of the Apennines. The city was noted for its temple of Jupiter but in modern times has become famous for the *Tabulae Iuguviae,* found at Gubbio in 1444. The tablets constitute a Rosetta stone for the Umbrian and Latin dialects, four of the inscriptions being in Umbrian, two in Latin, and one mixed. Originally there were nine such tablets but the city is in possession of only seven at the present time.

ÎLE DE FRANCE. *See* MAURITIUS.

ILFRACOMBE, a watering-place lying in wooded, hilly country, on the Bristol Channel, 225 mi. southwest of London. Originally the Saxon *Alfreincombe,* in the 14th century it was a prominent seaport, and in late 16th century boasted Sir Philip Sidney as Lord of the Manor. To-day, except for the Norman and Perpendicular Trinity Church of 12th century foundation, the ruins of St. Nicholas' Chapel and of a lighthouse upon Lantern Hull—a rock in the harbor—, Ilfracombe is of modern construction. The obsolete old town crests the cliffs, and the modern resort is terraced behind. There are fine walks along the seafront. Pop. (of district and town) 1921, 11,772; 1931, 9,174.

ILIAD, THE, a Greek epic attributed to HOMER, composed probably in the 9th century B.C. This superb poem in 24 books written in Greek hexameters, deals with the lofty theme of the Greek siege of Troy. After three books of introductory matter, the first notable incident is the combat between Paris, the Trojan abductor of Helen, and Helen's husband, Menelaus of Sparta (Paris is overthrown but borne to safety by Venus). Then, the command of Agamemnon, leader of the Greek forces, that the Trojans surrender, being refused, the siege begins, with the gods themselves taking sides. The climax is reached when Achilles, bravest of the Greeks but heretofore inactive because of a quarrel with Agamemnon over a captive, Briseis, slays Hector, greatest of the Trojan warriors. The poem closes with the funeral rites for Hector; from this point the story was resumed by Vergil in THE ÆNEID.

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ILION, a village in Herkimer Co., eastern New York, situated on the Mohawk River and the State Barge Canal, 12 mi. southeast of Utica. It is served by two railroads. Dairying, fruit growing and truck farming are the agricultural interests of the vicinity. The chief local manufactures are firearms, typewriters, cash registers, store fixtures, sweaters, and office equipment. In 1828 Eliphalet Remington built a factory in Ilion in which he made and perfected the firearms adopted by the United States Army. Later the Remington Company made farm tools, sewing-machines, bicycles and typewriters. Ilion was incorporated in 1852. Pop. 1920, 10,169; 1930, 9,890.

ILION or **ILIUM.** *See* TROY.

ILKESTON, a market town and municipal borough of Derbyshire, England, 8 mi. northeast of Derby. A very ancient town, it was mentioned in the Domesday Survey. Among its few remaining antiquities is the Norman and Early English Church of St. Mary containing a splendid 13th century chancel screen. The town manufactures are principally of hosiery, lace and various earthenwares. Coal is mined, and iron wrought in the neighborhood. Pop. 1921, 32,266; 1931, 32,809.

ILLEGITIMACY. The condition before the law of children born out of wedlock. Much of the law of inheritance and of family law comes down from a kin-organized society. Hence the claims of the illegitimate child were not recognized. This stage of the law was strengthened by considerations of maintaining marriage and the family as paramount social institutions. In some systems of law, indeed, illegitimate children were not merely excluded from inheritance, but were subject to serious legal disabilities. In the civil law, legitimation may take place by subsequent marriage of the parents. This doctrine was not accepted in the common law, but has been introduced frequently by legislation. Also legislation provided for a formal recognition of parenthood, and legitimation is not uncommon. In addition recently the coming in of a new idea of inheritance as depending upon claims to support has led to legislation in some parts of the world allowing illegitimate children to succeed to property. There is a tendency toward wider recognition of the claims of such children, but a proper balance between their claims and security of the institution of marriage is not easy to achieve.

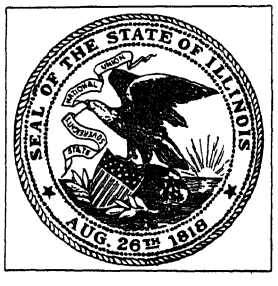
The U.S. Bureau of the Census showed 63,942 births out of wedlock in 1928, including no records from six states. For social and economic reasons many of these children are separated from their mothers soon after birth, so that their death rate in infancy is higher than that of other babies. Gradually society is recognizing its obligation to protect this group of children through special legislation providing for court proceedings, not criminal in character, to establish paternity and provide financial support by the father. These proceedings are usually brought by the mother or by the State in the child's behalf. Legislation requiring the licensing and supervision of maternity hospitals by State authorities has helped in checking the careless barter of children by unscrupulous commercialized hospitals. The more modern terms, children born out of wedlock or natural children, are being substituted for illegitimate children and bastards.

ILLIMANI, a mountain of Bolivia and a summit of the Andes, a few miles southeast of La Paz. It is a serrated ridge which terminates in three snowy peaks, the highest of which is 22, 570 ft. above the sea. Illimani is unsurpassed for its imposing grandeur and varied aspects. It rises close to La Paz above the profound gorge through which the Titicaca basin formerly sent its overflow to the inland sea. In 1898 Sir Martin Conway for the first time ascended the highest point of Illimani.

ILLINIUM, a metallic chemical element belonging to the RARE EARTHS, whose existence was discovered by spectroscopic methods, in 1926, by Hopkins. It has had the chemical symbol Il assigned to it, but the atomic weight and its properties are as yet unknown.

ILLINOIS, a North American Indian tribal confederacy including the Cahokia, Kaskaskia, Michigamea, Moingwena, Peoria and Tamara. They belonged to the Algonkian linguistic stock and formerly occupied southern Wisconsin, northern Illinois, and parts of Iowa and Missouri. They were in turn at war with the Sioux, Fox and Iroquois. Their murder of the famous chief, PONTIAC, instituted an exterminating war of vengeance on the part of the Algonkian tribes to the north and resulted in the loss of their territory to the Sauk, Fox, Kickapoo and Potawatomi. Late in the 19th century the remnants of these tribes were consolidated with the Wea and Piankashaw; the small number thus remaining lived in Oklahoma, but so mixed with white blood that their tribal identity is practically non-existent. Culturally, they were typical Central Algonkins, living in mat-covered lodges and practicing tree burial, polygamy and other characteristic customs.

ILLINOIS, one of the north central states of the United States, popularly called the "Prairie State" or "Sucker State." It is situated between 37° and 42° 30′ N. lat. and 87° 35′ and 91° 40′ W. long. On the north it is bounded by Wisconsin, on the east by Lake Michigan and Indiana, on the southeast and south by Kentucky from which it is separated by the Ohio River and on the southwest and west by Missouri and Iowa from which it is separated by the Mississippi River. Illinois comprises a total area of 56,665 sq. mi., of which 2,337 sq. mi. are water surface. This total area includes both inland water surface and jurisdiction over Lake Michigan and the Mississippi River to the middle of those bodies. In size Illinois ranks twenty-third among the states.



ILLINOIS STATE SEAL

Surface Features. Illinois comes within the great central lowland or prairie plains. The features which diversify its nearly level surface are terminal moraines deposited by the receding ice sheet, the Shawnee Hills, an offshoot of the Ozark Mountains, in the southern extremity of the state and the bluff-bordered trenches of the main rivers. These bluffs, often steep and generally wooded, provide the most picturesque scenery in the state. STARVED ROCK, rising above the Illinois River at Utica, is celebrated as the spot where LaSalle built Fort St. Louis. Charles Mound, 1,241 ft. high, in the far northwestern corner, is the highest point in the state. The lowest, 279 ft., occurs at Cairo where the Ohio and Mississippi rivers meet. The mean elevation above sea level is 600 ft.

Illinois is divided between two drainage systems. Lake Michigan drains only 1.3% of its area, and the Mississippi River with its tributaries, the ROCK, ILLINOIS, KASKASKIA, WABASH and OHIO, drains the remainder.

Climate. By reason of the mid-continental position of the state, the climate of Illinois displays marked variations between summer and winter. Further, because of its great extent in latitude, there is considerable variation between the northern and the southern portions. Mean annual temperatures range from 50.2° F. at Chicago in the north to 58.2° F. at Cairo in the south, with a mean annual temperature for the entire state of 52.4° F. Cairo has an average temperature of 34.9° F. for January and 79.6° F. for July, Chicago of 25.1° F. for January and 73.9° F. for July. During the period, 1895-1930, the highest temperature recorded in Illinois was 115° F. and the lowest, —35° F. The average annual precipitation is 36.3 in., varying from 32.9 in. at Chicago to 40.7 in. at Cairo. Average dates for the last killing frosts in spring range from March 31 for Cairo to April 18 for Chicago and those of the first killing frosts in the autumn from Oct. 18 for Chicago to Oct. 29 for Cairo, giving an average growing season at Chicago of 183 days and at Cairo of 212 days.

Forests and Parks. Illinois has approximately 3,000,000 acres of woodland out of an original 16,000,000 acres which covered the northeast corner and the southern third of the state with almost continuous forests. Of some 50 native trees the principal varieties are oak, elm, walnut, hickory, hard maple, red gum and sycamore. The Judy Memorial State Forest in Menard Co., comprises 80 acres of virgin hardwood timber. Bellevue-Savanna National Forest of 10,710 acres is located along the Mississippi River in the northwestern portion of the state. The Cook County Forest Preserve encircling the city of Chicago is one of the best developed county projects in the country. *See* COUNTY PARKS. Practically all of the 11 state parks and 12 state monuments are of historical interest. Recreational facilities of the parks, including free camping grounds, have been most extensively developed at STARVED ROCK.

Minerals and Mining. Nearly two-thirds of the land area of Illinois is underlaid with deposits of bituminous coal. These coal beds, mined in upwards of 50 counties, chiefly in the central and southwestern sections, constitute the most valuable of the state's mineral resources. Petroleum is found in the southeastern counties and there are also important deposits of limestone, sandstone, clay, molding sand and fluorspar. Lead was formerly mined in the Galena district and zinc has been produced in limited quantities.

With mineral productions in 1929 amounting to $182,791,131, Illinois stood seventh among the states, ranking second in fluorspar, third in coal, fourth in clay products, sand and gravel and fuller's earth, and sixth in limestone.

The principal product was coal, 60,657,641 tons, valued at $113,453,000. Other mineral outputs of im-

portance were clay products, $27,391,068; cement, 7,738,208 bbls., $11,134,538; petroleum, 6,319,000 bbls., $10,430,000; sand and gravel, 18,256,203 tons, $9,071,238; limestone, $7,830,131, and fluorspar, $1,434,122. Among minor products in order of value were lime, molding sand, natural gasoline, clay, natural gas, sand and sandstone, and silica.

During 1929 562 mines and quarries gave employment to 56,392 persons who received $80,519,015 in salaries and wages. Of these, 52,196 persons, or 93%, were engaged in coal mining.

Soil. Illinois on the whole is noted for the excellence of its soils. These vary from rich, glacial deposits in the north produced by the younger drift sheets to deposits of somewhat less fertile quality in the south laid down by the oldest drift sheet. These drift deposits, which comprise the surface soils, are often overlaid by a black loam from 10 to 15 in. in depth. Throughout most of the state, there is a subsoil of yellow clay. Rich alluvium is found in the river bottom, and loess, a highly fertile siliceous deposit, occurs along the river bluffs.

Agriculture. Illinois has long ranked as a leading agricultural state. The chief farm crops are corn, oats, wheat, hay, vegetables and fruits.

In 1930 30,695,339 ac. or 85.6% of the entire land area was in farms, 214,497 in number, with an average size per farm of 143.1 ac. and an average value per acre of $108.68. Of the farm area 21,139,907 ac. or 69% was crop land; 7,607,035 ac. or 25%, pasture land; and 731,936 ac. or 2%, woodland. The total value of farm property was $3,786,661,124, of which $3,336,049,028 was represented by land and buildings; $160,412,877, by implements and machinery; and $290,199,219, by domestic animals.

According to the census of 1930 Illinois produced in 1929 field crops to the value of $387,220,212, ranking fourth among the states. It stood second in corn and oats, seventh in hay, and tenth in wheat and barley; it ranked second in sweet corn, fourth in asparagus, seventh in onions and tenth in all vegetables harvested for sale. Illinois also stood third in peaches, fifth in pears and tenth in apples and grapes. The chief crops were grains $303,072,221, hay and forage $50,044,412, vegetables $22,212,824, and fruits $10,711,504.

Corn, oats and wheat are the leading grain crops. Of 8,574,608 ac. devoted to corn, 7,774,070 ac. harvested for grain produced 275,850,097 bu. and 243,137 ac. cut for silage yielded 1,719,593 tons. Oats were grown on 3,856,217 ac. with a yield of 128,257,740 bu., and wheat on 2,093,399 ac. with a yield of 30,150,949 bu. Other grain crops were barley, 9,381,100 bu., and rye, 689,026 bu.

Of the hay crop of 3,610,645 tons, 2,495,108 tons or 69% were timothy and clover, and the remainder largely alfalfa and annual legumes.

Among the vegetables were potatoes valued at $6,077,528; sweet corn, $2,013,391; tomatoes, $1,172,577; onions, $954,512; asparagus, $676,928; sweet potatoes, $596,080, and cabbages, $585,788. The leading fruit crops were apples 3,025,895 bu., peaches 2,863,999 bu., pears 538,667 bu., grapes 11,994,509 lbs. and strawberries 9,718,438 qts.

Farm products sold by cooperative marketing rose from $47,920,487 in 1919 to $48,933,674 in 1929, and farm supplies purchased by this method, from $3,333,667 to $3,826,054. Farm machinery and equipment in 1930 included 192,873 automobiles, 40,371 motor trucks, 69,628 tractors, 15,557 electric motors, and 79,300 stationary gas engines.

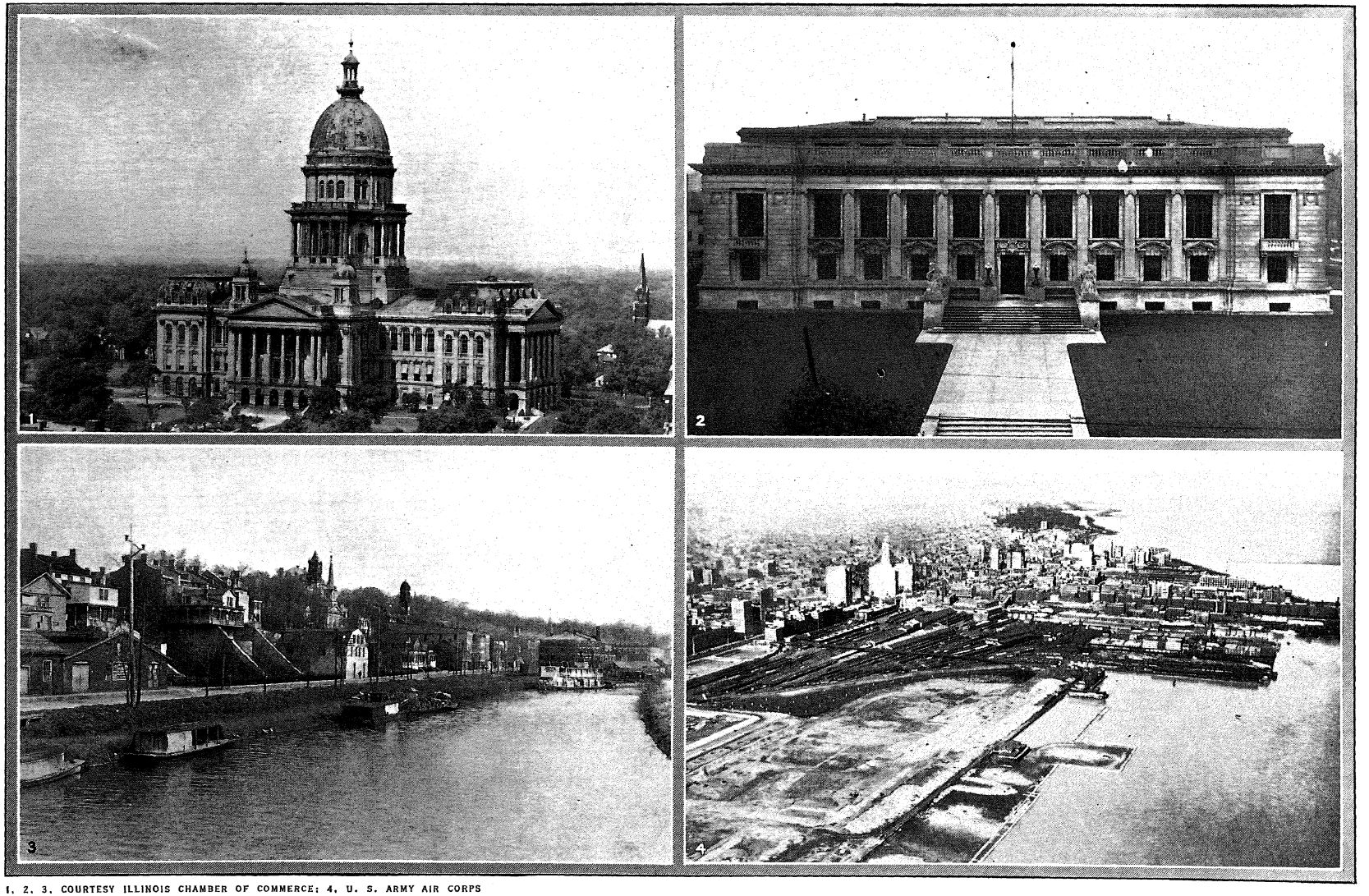
Animal Industry. Cattle-raising, chiefly for milk production, and hog-raising are the principal livestock interests. According to the census of 1930, the rank of Illinois among the states was second in horses, third in swine and sixth in milk cows on farms; the state stood third in chickens raised, fifth in milk and chicken eggs produced, seventh in dairy products sold, and fifth in total value, $290,199,219, of domestic animals on farms. Among the last named were 2,342,125 cattle reported from 194,195 farms or 90% of all farms in the state and valued at $135,920,252; horses, 820,850 in number valued at $60,469,762; mules, 133,457, $11,566,623; swine, 4,651,772, $54,745,632, and sheep, 944,597, $7,186,346.

Of the cows on farms, 1,087,492 were kept mainly for milk production and 175,638 mainly for beef production. In 1929, 506,374,072 gals. of milk were produced; the total value of dairy products marketed was $75,123,673, including $49,543,859 for whole milk and $22,251,128 for cream sold as butterfat. The value of all poultry raised was $37,072,815. The number and value of the chief kinds were chickens, 38,125,130, $34,975,016; ducks, 1,082,442, $1,059,557; geese, 408,360, $752,360, and turkeys, 91,487, $285,882. The chickens sold, 18,405,007 in number, were valued at $17,408,321. Of 136,829,559 doz. chicken eggs produced, valued at $39,738,267, 102,563,892 doz., with a value of $29,727,411, were marketed. The sheep industry yielded 3,536,846 lbs. of wool valued at $1,205,427. Honey, totaling 4,107,736 lbs. valued at $646,614, was produced from 149,043 hives.

Fisheries. In 1930, Illinois fisheries on the Mississippi River took 17,585,000 lbs., valued at $945,000; in addition, 611,000 lbs. of fish valued at $76,000 were taken from lakes. The most important species were buffalo fish, carp, catfish, sheepshead, suckers and sunfish. The state issued 385,127 fishing licenses and received $170,455.22 in fees. Six hatcheries are in operation.

Overflooding of the Mississippi River results in the loss of millions of fish annually, and in 1930 the United States Bureau of Fisheries station at Andalusia rescued and restored to the river 9,432,385 fish. In addition, the activities of the Federal Bureau included the planting of 3,880,000 catfish, 172,000 buffalo fish, 279,025 carp, 28,000 trout, 3,927,275 crappie, 454,900 sunfish, 11,040 bass and 717,000 miscellaneous fish.

Transportation. The development of Illinois has always been stimulated by cheap and adequate transportation facilities. The Great Lakes and the Ohio River were extensively used by the earliest settlers of



1, 2, 3, COURTESY ILLINOIS CHAMBER OF COMMERCE; 4, U. S. ARMY AIR CORPS

CHICAGO, SPRINGFIELD AND GALENA, ILLINOIS

1. State Capitol at Springfield. **2.** Supreme Court Building, Springfield. **3.** A waterway of Galena, recalling the days of water-borne traffic in the Middle West. **4.** Aerial view of Chicago and the North Side, showing, in the left center, the railway freight terminal and Wrigley Building, and in the upper right center, Lincoln Park.

Illinois, including more than half the present state and, until 1723, extending from the Mississippi to the Rocky Mountains, was given a commandant and judge, and the capital placed at Ft. Chartres. The country was ceded to Great Britain in 1763 (*see* PARIS, TREATY OF); after PONTIAC'S CONSPIRACY had been suppressed, the British took possession of the Illinois settlements in 1765. Despite the King's Proclamation of 1763 colonial immigration, especially from Virginia, filtered in to dilute the French stock. In 1774 Illinois was annexed, for governmental purposes, to the province of Quebec (*see* QUEBEC ACT). A Revolutionary force seized the garrisoned posts, Cahokia and Kaskaskia, in 1778 (*see* CLARK, GEORGE ROGERS); the treaty closing the war, 1783, awarded the territory to the United States. Virginia had in 1778 extended its civil government to the captured regions. Capt. John Todd of Kentucky was appointed governor of "the County of Illinois," the entire domain north of the Ohio. This nominal government was succeeded by Territorial organization under the Congress of the Confederation (*see* ORDINANCE OF 1787). In 1800 the Illinois country was included in the Territory of Indiana. In 1809 the Territory of Illinois was created, including, beside the present state, most of WISCONSIN and parts of MICHIGAN and MINNESOTA. Indian land titles were extinguished; Indian hostilities, which had prevented settlement in the northern section, as the FT. DEARBORN MASSACRE were quelled by the close of the WAR OF 1812; and on Dec. 3, 1818, Illinois, with a population of almost 40,000, became a state. A period of rapid settlement and hectic land speculation followed, and was accelerated by the outcome of the BLACK HAWK WAR. State-established systems of banking, 1819-1843, and subsidizing of public improvements, 1836-1840, proved unfortunate; but the people recovered quickly, and, led by the enterprising citizens of Chicago, the state steadily progressed in material wealth. Springfield became the capital in 1837.

Southern emigrants were for many years in the majority, and southern Illinois was largely sympathetic to slavery. An attempt in 1824 to legalize slavery in the state was defeated. The Abolitionist editor Elijah P. Lovejoy was murdered at Alton in 1837. In 1858 occurred the famous LINCOLN-DOUGLAS DEBATES. The state furnished 255,092 troops to the nation during the CIVIL WAR; but, especially in the southern counties, opposition to the national policy was rife. After an exciting campaign the electoral votes of Illinois were won for Lincoln in 1864 by a small margin. The production of wheat during the Civil War made Illinois prosperous, while Chicago became the leading livestock market of the world. The concentration of railroads in Illinois and the consequent establishment of large factories have been dominant influences in the social and political history of the state. A sharp division of opinion between urban Chicago and rural southern Illinois has been often expressed. Normally Republican, Illinois in 1930 shifted its allegiance, largely because of disapproval of prohibition, and elected J. Hamilton Lewis, Democrat, to the Senate. In 1932 William H. Dieterich and Henry Horner, both Democrats, were elected senator and governor respectively.

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ILLINOIS, UNIVERSITY OF, at Urbana, Ill., a coeducational state institution, supported chiefly by the State of Illinois. Incorporated in 1867 as the Illinois Industrial University, it was opened at Urbana in 1868, the present title being assumed in 1885. In its growth the university has extended beyond Urbana into Champaign, an adjacent city. The departments at these two cities include schools and colleges of Liberal Arts and Sciences, Agriculture, Engineering, Commerce, Education, Law, Library Science, Music and Journalism and the Graduate School. The colleges of Medicine and Dentistry and the School of Pharmacy are located in Chicago. Agricultural and engineering experimental stations are maintained for special research in these fields. Among the notable discoveries made in the university is that of the chemical element illinium in 1925, the achievement of Prof. B. Smith Hopkins of the university staff and his colleagues. The institution had a total income in 1931 of $7,344,335. The library contains 877,884 volumes. In 1931 there was a student enrollment of 12,152 and a faculty of 1,490 headed by Pres. HARRY WOODBURN CHASE.

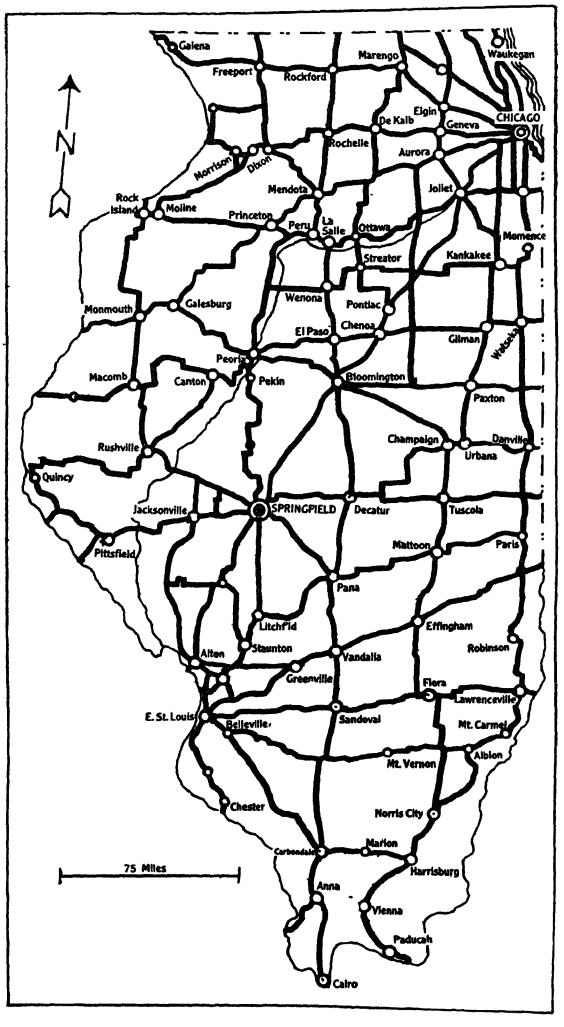
ILLINOIS COLLEGE, at Jacksonville, Ill., a coeducational, privately controlled and non-sectarian institution with Presbyterian affiliation. Founded in 1829 by a group of Yale graduates cooperating with a local group, it graduated the first college class in the state. Its productive funds in 1931 were $1,113,268. The library contained 27,000 volumes. In 1931-32 there were 414 students, and a faculty of 29, headed by Pres. C. H. Rammelkamp.

ILLINOIS RIVER, the largest river in Illinois, formed by the junction of the Des Plaines and Kankakee rivers in Grundy Co. It flows generally southwest through the state and empties into the Mississippi just above Alton. The estimated length of the Illinois is 350 mi., all of which is navigable. At LaSalle it is connected by a canal with the south branch of the Chicago River, thus establishing water communication between Lake Michigan and the Mississippi River. The largest tributaries of the Illinois include the Fox, Sangamon, Vermillion and Spoon rivers. The important cities on its course are Peoria, Ottawa, LaSalle and Pekin.

ILLINOIS WESLEYAN UNIVERSITY, a coeducational institution at Bloomington, Ill., affiliated with the Methodist Episcopal Church. It was opened in 1850 but through lack of funds was suspended and reopened twice in its first 20 years. The institution had productive funds in 1931 amounting to $1,235,271. The library contained 35,667 volumes. In 1931-32 there were 482 students and a faculty of 50, headed by Pres. William J. Davidson.

ILLITERACY, as defined by the United States Bureau of the Census, "inability to write in any language, not necessarily English," in persons 10 years

the territory. The first canal in the state, connecting the Mississippi River with Lake Michigan, was completed in 1848. It ran from Lake Michigan to La Salle, at the head of navigation on the Illinois River. In 1890, the sanitary district of Chicago constructed a canal between Chicago and Lockport, where it joined the one mentioned above. In 1907, the Federal Government completed a canal from Hennepin to Rock River, providing Chicago with an improved waterway to the Mississippi. None of these waterways are extensively used now, probably due to the convergence of practically all the transcontinental lines at Chicago, which makes Illinois a honeycomb of steam railways. In 1930 the total railway mileage was 12,510, second only to Texas, the largest state in the Union. Double-tracking and expansion of terminal facilities has occasioned an increase in mileage contrary to the recent national trend toward slight decrease.



ILLINOIS STATE ROADS

Steadily and rapidly the highways are being extended and improved. On Jan. 1, 1930, there were 118,662 mi. of highway, including 21,375 mi. of surfaced roads and 6,901 mi. of state highways. The total highway expenditure during 1929 was $66,093,326, of which $37,708,842 was paid by the state and $28,384,484 by county and local governments. Motor vehicle registrations were 1,638,260 in 1930, compared with 1,263,177 in 1925. Truck registrations were 207,584 in 1930 as against 161,234 in 1925. During the same period, the number of buses in operation increased from 1,546 to 2,390.

Manufactures. Illinois is one of the foremost manufacturing states with very extensive and highly diversified industries. Primarily these are based upon the state's exceedingly rich agricultural resources and its immense deposits of coal and other valuable minerals. A factor of prime importance also is the central position of the state in the most highly developed and densely populated section of the Middle West. In addition to these advantages of position and resources, the state possesses unsurpassed transportation facilities, including an enormous network of railways radiating from the greatest railway center of the continent and also a vast system of inland water communications by way of the Great Lakes and the Mississippi River.

According to the Census of 1930 Illinois with manufactures for 1929 valued at $6,282,092,240 stood third among the states. Its 15,333 establishments gave employment to 135,952 officers and employees, who received $368,721,898 in salaries, and to 691,555 wage earners, who were paid $1,024,870,235 in wages. These factories used a total of 2,807,001 horse power, expended $166,515,980 for fuel and power, and $3,185,538,499 for materials and supplies, and added by the process of manufacture $2,930,037,761 to the value of their output.

This output included some 220 products which were separately reported by the Census. The pre-eminent industry was meat packing, the products of which were more than double in value those of any other state, and usually comprise more than one-fifth of the total for the United States. While surpassed in value of products by New York and Pennsylvania, the outstanding position of Illinois in manufactures is indicated by the fact that in some 50 important groups of products Illinois did not rank lower than fifth among the states. Among those in which it stood first were meat packing, agricultural implements, electrical machinery, electric and steam railway cars, engines, steam fittings, paints and varnishes, corn sirup, sugar, starch and oil, confectionery, tin cans and wooden boxes. The state was second in the output of book and job printing, furniture, men's clothing, women's clothing, gas and electric fixtures, stoves and ranges, wire, paper boxes, coffee roasting and grinding, feeds for animals, paper boxes, wood preserving, patent medicines and various other products. Among the manufactures in which Illinois stood third were the printing and publishing of newspapers and magazines, foundry and machine shop products, pig iron, bread and bakery products, ma-

chine tools, hardware, perfumery and cosmetics, beverages and ice cream. The state ranked fourth in the production of coke, boots and shoes, condensed milk and manufactured ice; fifth in canning and preserving, and the production of cheese, glass, and leather.

The leading manufacturing industries, which produced more than half of the output of the state, in order of value were:

Industry or Product	*No. Persons Employed*	*Value of Products $*
Meat packing	32,959	760,872,847
Electrical machinery	72,982	435,021,917
Foundry and machine shop products	55,089	317,485,569
Iron and steel rolling mill products	34,187	268,077,085
Printing and publishing, newspaper and periodical	25,286	178,015,526
Printing and publishing, book and job	34,024	176,222,985
Agricultural implements	25,326	143,678,378
Bread and bakery products	18,961	138,591,365
Furniture	26,406	130,535,112
Men's clothing	23,558	118,475,388
Engines and turbines	15,519	112,622,154
Petroleum refining	4,808	104,130,272
Steam railway carshop construction and repairs	33,553	99,622,310
Corn sirup, sugar, oil, and starch	4,091	94,773,487
Confectionery	12,800	91,116,763
Paints and varnishes	5,709	90,399,091
Pig iron	2,902	82,566,913
Electric and steam railway cars	11,462	82,479,979
Women's clothing	15,216	75,649,695

Chicago with its immediate environs in Cook Co. is the preeminent industrial center, producing in 1929 an output valued at $4,450,000,000 or 70% of the total for the state. Other cities with products valued at upward of $50,000,000 were Rockford, $96,646,100; East St. Louis, $88,762,693; Peoria, $66,938,147; Granite City, $58,104,853, and Decatur, $51,633,868.

Commerce. According to the census of 1930, there were in 1929 11,588 wholesaling establishments in Illinois, with total sales of $6,860,820,303. This volume represented nearly 10% of the total for the United States, and was exceeded only in New York State. These wholesaling organizations gave full-time employment to 164,563 men and women, whose annual salaries aggregated $341,533,487. Chicago, the second largest wholesale distributing center in the country, reported wholesale trade of $5,928,994,384. Peoria and East St. Louis are also important.

The total sales of the 97,074 retail stores amounted to $3,687,370,356, a volume surpassed only by New York and Pennsylvania. Sales per store averaged $37,985; sales per capita, which were $483.23, were greater in only five other states.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	*No. of Stores*	*Sales*	*% of Total*
Food	31,328	$830,380,497	22.52
General Mdse.	6,115	667,119,614	18.09
Automotive	13,901	606,535,142	16.47
Apparel	9,041	348,968,514	9.46
Lumber & Bldg.	5,879	269,360,735	7.31
All other stores	30,810	965,005,854	26.15
Total, all stores	97,074	$3,687,370,356	100.00

Chicago, the principal port, handled water-borne commerce amounting to 17,552,820 tons, with a value of $217,490,426.

Finance and Banking. The assessed value of all real property in Illinois in 1928 was $6,400,647,418. On Oct. 1, 1930, the state's funded debt, consisting principally of highway and soldiers' bonus bonds, aggregated $199,740,000. Prior to 1837, in connection with its financial support of the railroads and banks and the construction of the Illinois and Michigan canal, Illinois had issued bonds to the extent of about $14,000,000. When the panic of 1837 occurred, construction of public improvements was necessarily discontinued. The numerous bank failures also reacted to the financial disadvantage of the state. In July 1841, Illinois was forced to defer payments of interest on its bonds; in 1844 it was still unable to meet its obligations. The revenue from the Illinois & Michigan canal, completed a few years later, made it possible for the state to resume interest payments, and the discharge of the principal amount was soon begun. Taxes were levied to amortize the balance of the bonded debt. As a result, the state was entirely out of debt by 1870. A new period of borrowing, principally in behalf of highways, began in 1921. Total revenue receipts for the year ended June 30, 1930, were $105,433,664, while total expenses were $96,570,388. The principal sources of income were motor vehicle taxes, $18,701,735, gasoline taxes, $19,465,073, inheritance taxes, $15,666,368, corporation and business taxes, $14,713,849 and general property taxes, $12,268,025. The principal expenditures were for general department overhead, including the University of Illinois, $51,293,901, construction and maintenance of highways, $27,828,493, debt service, $11,877,700 and public school aid, $4,062,873.

There were 1,567 banks in Illinois in 1930, of which 438 were national banks and 1,129 state banks and trust companies. These institutions had an aggregate capital of $339,573,252 and surplus and undivided profits of $310,557,000. Their total resources amounted to $4,882,319,000; their loans and discounts, including rediscounts, aggregated $2,820,627,000. Total demand deposits were $1,877,395,000 and total time deposits including postal savings, were $1,590,338,000. Per capita demand and time deposits in 1930 were $454.07; per capita savings deposits, $186.79. The total savings of $1,426,536,000 were owned by 4,757,804 depositors. National bank circulation in Illinois aggregated $36,001,000 in 1930. Bank clearings were $31,807,254,000 in Chicago, which was second only to New York city in banking activity.

Government. The legislative power of the state is vested in the general assembly consisting of a senate composed of 51 members and a house of representatives of 153 members, the former elected for terms of four years and the latter for terms of two years. They meet in biennial sessions unlimited in duration. The executive department consists of a governor, lieutenant governor, secretary of state, auditor, treasurer, superintendent of public instruction, and attorney-

general, all elected for terms of four years except the treasurer who is ineligible for re-election after holding office two years. The governor receives a salary of $12,000 per year. He has the usual veto power. Judicial power is vested in a supreme court, circuit courts, appellate courts, county courts and probate courts. The supreme court consists of seven judges elected for terms of nine years at salaries of $15,000 per annum.

Social Welfare Institutions. The Department of Public Welfare administers the state penal and charitable institutions. There are schools for the blind and deaf at Jacksonville and an industrial home for the blind at Chicago, a training school for girls at Geneva and for boys at St. Charles. At Normal is a soldiers' orphans' home, at Wilmington a soldiers' widows' home and a soldiers' and sailors' home at Quincy. Hospitals for the insane are located at Elgin, Jacksonville, Anna, Watertown, Peoria, Chester, Chicago, Alton and Kankakee, and institutions for feeble-minded are at Lincoln and Dixon. Chicago has an eye and ear infirmary. At Joliet there is a penitentiary and women's prison, at Pontiac is a reformatory and a second penitentiary at Menard. A state farm is maintained at Vandalia. The poor are cared for by the counties.

Education. The first school was founded by the Jesuits at Kaskaskia in 1754. This was followed by a school in Monroe County, near St. Louis, taught by John Seeley in 1783. In Cook County the first school was opened in 1816. In 1825 a general school law was enacted, providing for common schools in every county. In 1929 there were 11,955 public elementary school districts with approximately 35,000 teachers and 1,099,440 pupils. The 956 public high schools had 10,971 teachers and 286,635 pupils. Children from 7 to 16 years of age are required to attend school the full term.

The number of persons from 5 to 20 years of age attending school in 1930 was 1,548,001, or 71.2% of the population within the ages specified, as compared to 1,226,601, or 65%, in 1920. Persons 10 years and over unable to read and write in 1930 numbered 153,507, or 2.4%, as compared to 173,987 illiterates, or 3.4%, in 1920. Foreign-born white illiterates numbered 108,984, or 9%, in 1930; and 131,996, or 11%, in 1920.

There are 50 colleges, universities and junior colleges in Illinois. State institutions of higher learning include the University of Illinois at Urbana and teachers' colleges at Normal, Carbondale, DeKalb, Macomb and Charleston. Of the other educational institutions, the more important are the University of Chicago, Northwestern University at Evanston, Illinois Wesleyan University at Bloomington, Loyola University at Chicago, James Millikin University at Decatur, De Paul University at Chicago, Bradley Polytechnic Institute at Peoria, Knox College at Galesburg and Illinois College at Jacksonville. The Library Extension Division of the Illinois State Library has its headquarters at Springfield.

Population. In 1930 Illinois ranked third among the states with a population of 7,630,654 or an average of 136.2 per square mile, an increase of 1,145,374 or 17.7% from 1920. The population rose from 55,211 in 1820 to 851,470 in 1850, 4,821,550 in 1900, 5,638,591 in 1910, and to 6,485,280 in 1920. In 1930 there were 7,266,361 or 95.2% whites and 328,972 or 4.3% Negroes, an increase of 15.4% whites and 80.5% Negroes. Of the whites, 6,048,203 were native born, an increase of 955,821 from 1920, and 1,218,158 were foreign born, an increase of 11,207 from 1920. Of the total foreign stock, including foreign born, foreign and mixed parentage, 794,626 or 22.7% were German; 470,832 or 13.5%, Polish; 271,489 or 7.8%, Italian; 261,374 or 7.5%, Swedish; 244,959 or 7.0%, Irish. The urban population was 5,635,727 or 73.9% of the total, an increase of 1,232,574 or 28.0% from 1920; the rural population was 1,994,927 or 26.1% of the total, a decrease of 87,200 or 4.2% since 1920. There were in 1930 five cities of 70,000 and upwards; Chicago, 3,376,438; Peoria, 104,969; Rockford, 85,864; East St. Louis, 74,347; Springfield, 71,864.

Occupations. In 1930 3,184,961 persons, or 41.7% of the population, were gainful workers 10 years old or older; 77.5% of these were males and 22.5% were females; 72.8% were native white; 21.3% foreign-born white; 5.4% Negro, and 0.6% other races. Of the females 15 years old or older 58.5% were single, 26.7% were married, and 14.9% were widowed or divorced.

Among the principal occupations, with number of workers, were factory operatives and laborers, 329,495 men and 102,673 women, including 72,969 persons in iron and steel industries, 41,743 in food industries, 33,118 in clothing industries, and 23,071 in electrical machinery factories; farmers, 208,602, and farm wage workers, 113,462; clerks, 143,451 men and 86,888 women; salespersons, 120,253 men and 42,969 women; servants, 23,219 men and 97,709 women; retail dealers, 115,462; stenographers, 2,750 men and 78,989 women; chauffeurs, 69,317; carpenters, 59,979; school teachers, 11,064 men and 48,804 women; machinists, 55,935; coal mine operatives, 54,137; bookkeepers and cashiers, 19,351 men and 34,743 women; painters and glaziers, 35,848; building construction laborers, 34,516, and steam railroad laborers, 32,812.

HISTORY

MARQUETTE and JOLIET reached Illinois in 1673, the former founding a mission at the village of the Kaskaskia Indians, near Utica, in 1675. LA SALLE entered Illinois in 1679, built Ft. Crevecoeur at Peoria Lake, and left HENRI DE TONTI to carry on the work of exploration. Some of the French trading posts and missions—Kaskaskia, Ft. Chartres, and Cahokia, all established about 1720—became permanent settlements. In 1712 the Illinois River was made the northern boundary of Crozat's grant. (*See* LOUISIANA, *History*.) In 1721 the Royal Council of France divided the Louisiana country into several provinces;

Illinois, including more than half the present state and, until 1723, extending from the Mississippi to the Rocky Mountains, was given a commandant and judge, and the capital placed at Ft. Chartres. The country was ceded to Great Britain in 1763 (*see* PARIS, TREATY OF); after PONTIAC'S CONSPIRACY had been suppressed, the British took possession of the Illinois settlements in 1765. Despite the King's Proclamation of 1763 colonial immigration, especially from Virginia, filtered in to dilute the French stock. In 1774 Illinois was annexed, for governmental purposes, to the province of Quebec (*see* QUEBEC ACT). A Revolutionary force seized the garrisoned posts, Cahokia and Kaskaskia, in 1778 (*see* CLARK, GEORGE ROGERS); the treaty closing the war, 1783, awarded the territory to the United States. Virginia had in 1778 extended its civil government to the captured regions. Capt. John Todd of Kentucky was appointed governor of "the County of Illinois," the entire domain north of the Ohio. This nominal government was succeeded by Territorial organization under the Congress of the Confederation (*see* ORDINANCE OF 1787). In 1800 the Illinois country was included in the Territory of Indiana. In 1809 the Territory of Illinois was created, including, beside the present state, most of WISCONSIN and parts of MICHIGAN and MINNESOTA. Indian land titles were extinguished; Indian hostilities, which had prevented settlement in the northern section, as the FT. DEARBORN MASSACRE were quelled by the close of the WAR OF 1812; and on Dec. 3, 1818, Illinois, with a population of almost 40,000, became a state. A period of rapid settlement and hectic land speculation followed, and was accelerated by the outcome of the BLACK HAWK WAR. State-established systems of banking, 1819-1843, and subsidizing of public improvements, 1836-1840, proved unfortunate; but the people recovered quickly, and, led by the enterprising citizens of Chicago, the state steadily progressed in material wealth. Springfield became the capital in 1837.

Southern emigrants were for many years in the majority, and southern Illinois was largely sympathetic to slavery. An attempt in 1824 to legalize slavery in the state was defeated. The Abolitionist editor Elijah P. Lovejoy was murdered at Alton in 1837. In 1858 occurred the famous LINCOLN-DOUGLAS DEBATES. The state furnished 255,092 troops to the nation during the CIVIL WAR; but, especially in the southern counties, opposition to the national policy was rife. After an exciting campaign the electoral votes of Illinois were won for Lincoln in 1864 by a small margin. The production of wheat during the Civil War made Illinois prosperous, while Chicago became the leading livestock market of the world. The concentration of railroads in Illinois and the consequent establishment of large factories have been dominant influences in the social and political history of the state. A sharp division of opinion between urban Chicago and rural southern Illinois has been often expressed. Normally Republican, Illinois in 1930 shifted its allegiance, largely because of disapproval of prohibition, and elected J. Hamilton Lewis, Democrat, to the Senate. In 1932 William H. Dieterich and Henry Horner, both Democrats, were elected senator and governor respectively.

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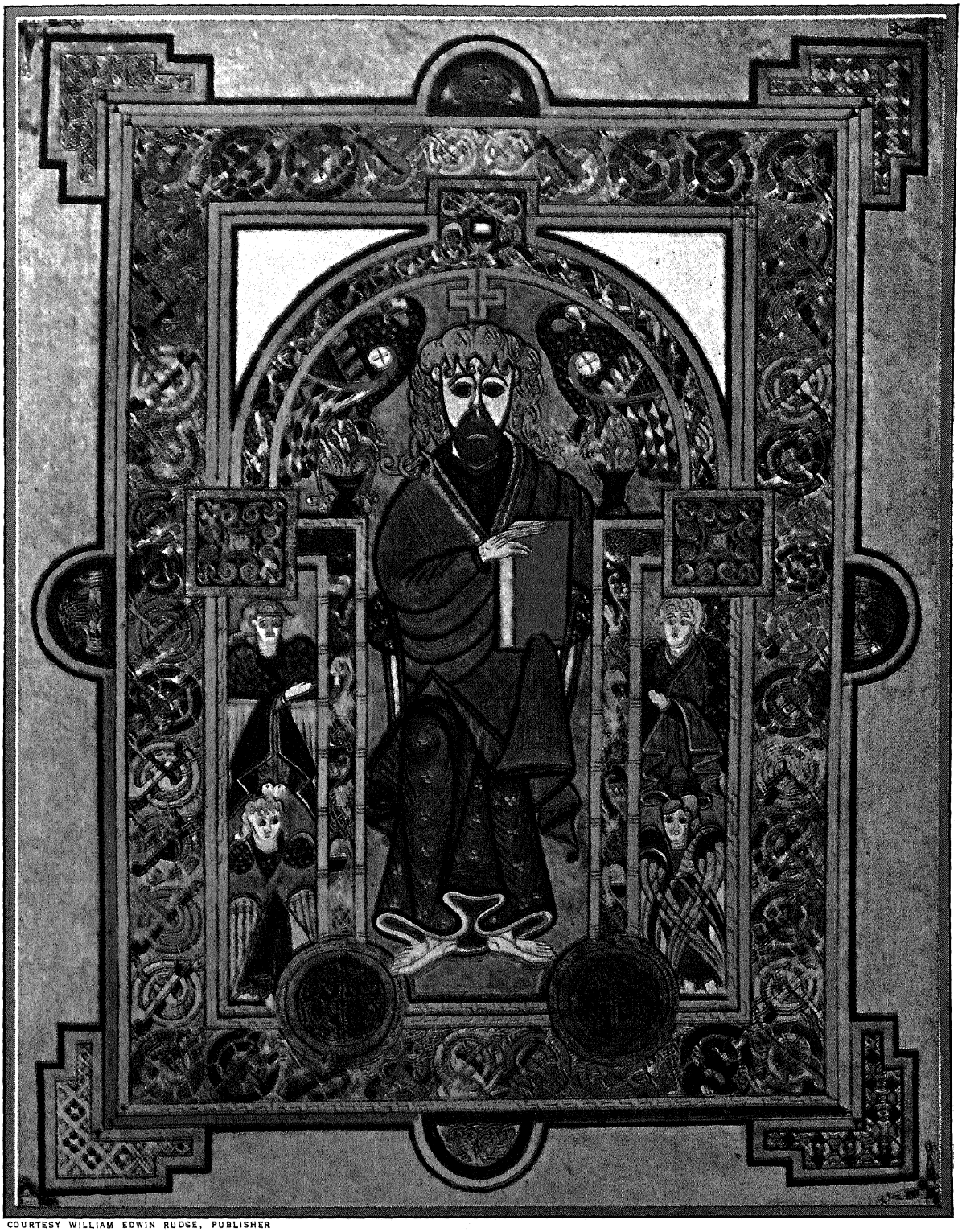
ILLINOIS, UNIVERSITY OF, at Urbana, Ill., a coeducational state institution, supported chiefly by the State of Illinois. Incorporated in 1867 as the Illinois Industrial University, it was opened at Urbana in 1868, the present title being assumed in 1885. In its growth the university has extended beyond Urbana into Champaign, an adjacent city. The departments at these two cities include schools and colleges of Liberal Arts and Sciences, Agriculture, Engineering, Commerce, Education, Law, Library Science, Music and Journalism and the Graduate School. The colleges of Medicine and Dentistry and the School of Pharmacy are located in Chicago. Agricultural and engineering experimental stations are maintained for special research in these fields. Among the notable discoveries made in the university is that of the chemical element illinium in 1925, the achievement of Prof. B. Smith Hopkins of the university staff and his colleagues. The institution had a total income in 1931 of $7,344,335. The library contains 877,884 volumes. In 1931 there was a student enrollment of 12,152 and a faculty of 1,490 headed by Pres. HARRY WOODBURN CHASE.

ILLINOIS COLLEGE, at Jacksonville, Ill., a coeducational, privately controlled and non-sectarian institution with Presbyterian affiliation. Founded in 1829 by a group of Yale graduates cooperating with a local group, it graduated the first college class in the state. Its productive funds in 1931 were $1,113,268. The library contained 27,000 volumes. In 1931-32 there were 414 students, and a faculty of 29, headed by Pres. C. H. Rammelkamp.

ILLINOIS RIVER, the largest river in Illinois, formed by the junction of the Des Plaines and Kankakee rivers in Grundy Co. It flows generally southwest through the state and empties into the Mississippi just above Alton. The estimated length of the Illinois is 350 mi., all of which is navigable. At LaSalle it is connected by a canal with the south branch of the Chicago River, thus establishing water communication between Lake Michigan and the Mississippi River. The largest tributaries of the Illinois include the Fox, Sangamon, Vermillion and Spoon rivers. The important cities on its course are Peoria, Ottawa, LaSalle and Pekin.

ILLINOIS WESLEYAN UNIVERSITY, a coeducational institution at Bloomington, Ill., affiliated with the Methodist Episcopal Church. It was opened in 1850 but through lack of funds was suspended and reopened twice in its first 20 years. The institution had productive funds in 1931 amounting to $1,235,271. The library contained 35,667 volumes. In 1931-32 there were 482 students and a faculty of 50, headed by Pres. William J. Davidson.

ILLITERACY, as defined by the United States Bureau of the Census, "inability to write in any language, not necessarily English," in persons 10 years



COURTESY WILLIAM EDWIN RUDGE, PUBLISHER

A PAGE FROM THE BOOK OF KELLS

A portrait believed to be either St. Mark or St. Luke in *The Book of Kells,* an illuminated manuscript dating from the 7th or 8th century. The book contains the Gospels in Latin and local records of early Ireland. It is now in the library of Trinity College, Dublin, Irish Free State.

of age and over. There were in 1930, 4,283,753 illiterate persons 10 years of age and over in the United States, amounting to 4.3% of the total population. The percentage of illiteracy varies greatly in different parts of the country. The rate for the New England Division was 3.7% in 1930; for the Middle Atlantic Division, 3.5%; for the East North Central Division, 2.1%; for the West North Central Division, 1.4%; for the South Atlantic Division, 8.3%; for the East South Central Division, 9.6%; for the West South Central Division, 7.2%; for the Mountain Division, 4.2%; for the Pacific Division, 2.1%. The urban illiteracy rate for the entire United States is markedly lower than the rural illiteracy rate. The trend of illiteracy from 1870 to 1930 was steadily downward, the 4.3% in 1930 contrasting with a rate of 20.0% in 1870.

Negroes and American Indians have high rates of illiteracy. Among native whites, the greatest illiteracy is in the southern states. The older age groups, wherever found, have particularly high rates, testifying to the lack of adequate educational facilities in the past. This lack of schools, which has been the main factor in illiteracy, has in turn been largely due to poverty and insufficient interest in education. S. W.

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ILLUMINATED MANUSCRIPTS, a term applied to hand-made books of papyrus, vellum or paper, adorned with colored lettering or illustrations in gold and color. While illustrated books, such as the Egyptian *Book of the Dead,* were produced as early as 1500 B.C., illumination is essentially a medieval art. Primarily an art of the monasteries, the chief culture centers of the Middle Ages, illumination, because of the international character of the church, represented the fusion of a number of art traditions. Of these the principal streams were the Byzantine and Celtic which, originating at opposite ends of Europe, traveled through Italy and England to meet in France under Charlemagne and his successors. Byzantine illumination, in spite of the lavish Oriental use of gold and color, remained largely illustrative, the human figure, as in the Roman work from which it stemmed, holding an important place. This use of the human figure, brilliantly colored, against a gold background was in direct contrast to the art of Ireland which, lacking all classical tradition, was weak in the representation of the human figure, tending toward an elaborate use of abstract design in which grotesque animal forms were interwoven with the greatest decorative subtlety. The so-called Carolingian illumination, which resulted from the fusion of Byzantine and Celtic influences with the native Franco-Lombard art, ranks among the most important of the early Middle Ages and includes such splendid specimens as Lothair's *Gospels* and the Bible of Charles the Bald.

A radical change came over the art of illumination at the end of the 12th century, and the conventional style then elaborated subsisted for more than 300 years. The chief feature of bibles of this period is the border which generally takes the form of a frame of fanciful foliage. Greater prominence is given to the manuscript itself, the double column page being mainly occupied with closely written characters, the "miniature," or representation of some scene relating to the text, being contained within the large initial.

By the 14th century greater skill in drawing had been attained not only in the delineation of the human form but in the representation of ornamental foliage. Scenery began to appear and the stiff, grotesque contortions of Byzantine figures and gold backgrounds gave way to freer and more graceful arrangements.

With the Renaissance the art of illumination attained its zenith as regards delicacy of coloring and perfection of drawing, while at the same time scientific skill brought about the destruction of illumination as an art in itself. From the perfection attained in the Middle Ages the decorative execution declined to a style characterized by miniatures treated realistically, in which the text assumes a secondary importance. Of this sort of illumination the *Bedford Hours* in the British Museum is an excellent example, while the taking over of the art by lay artists resulted in such masterpieces as the *Très Riches Heures* of the Duc de Berry.

With the invention of printing the art of illumination rapidly declined.

ILLUMINATI, a name applied to several schools of religious enthusiasts. The first *Illuminati,* or enlightened ones, known as the *Alumbrados,* arose in Spain in the 16th century, inspired by a Carmelite nun, La Beata de Piehdrahita. Rejecting the necessity of good works, the *Alumbrados* believed that perfection was attainable through meditation and mysticism. In France, one or two later groups were known as *Illuminés.* The best-known society of so-called *Illuminati* was that founded in Germany in 1776 by a lay professor at the University of Ingolstadt, Adam Weishaupt, who had been educated by the Jesuits but had adopted rationalistic ideas. This school, called also the Order of the Perfectibilists, had an elaborate organization based on Freemasonry and a frankly distorted imitation of the Jesuit Order. It was expected to accomplish the social regeneration of the world through its program of freedom, equality and "enlightenment." It spread rapidly into neighboring European countries until it had a membership of about 2,000. After 1780 it included numbers of Masons, Duke Frederick of Brunswick joining it in 1783. Goethe and Herder were among its members. Because of its anarchistic principles the order was finally suppressed in Bavaria in 1787. It gradually disintegrated, having left its stamp on the liberalism of the latter part of the 18th century.

ILLUMINATING ENGINEERING, that branch of science concerned with the theories of artificial lighting and with the practical application of illuminants. To efficiently utilize the light generated by modern sources and to obtain useful illumination, light

must be controlled. The light source must be shielded to prevent glare and the light rays must be properly diffused and directed. In 1906 the Illuminating Engineering Society was founded for the purpose of advancing the theory and practice of illuminating engineering and the dissemination of knowledge relating thereto. During the past 25 years available light sources have been thoroughly studied, extensive research work performed and appropriate lighting equipment developed. D. W. A.

ILLUMINATION, ARTIFICIAL, light from man-made sources, or lamps. During the past 50 years tremendous improvements have been made. Several thousand types and varieties of INCANDESCENT LAMPS are now available, ranging in size from the tiny surgical lamp having a bulb diameter of only ⅛ in. to the 10,000-watt lamp with a 10-in. bulb.

Industrial Lighting. The usual practice in more progressive plants is to use 200 or 300-watt lamps in porcelain-enameled steel reflectors of the dome type, mounted 10 ft. above the floor and spaced on approximately 10 ft. centers. In such places as high craneways concentrating reflectors of prismatic glass, mirrored glass or polished metal utilize either 1,000 or 1,500-watt lamps. For exacting operations, supplementary local lighting is also employed.

Commercial Lighting. Enclosing glass globes with either 200 or 300-watt lamps provide satisfactory illumination in offices and schools. Semi-direct enclosing globes are becoming increasingly popular where a better quality of illumination is desired. Similar lighting systems are used in retail stores. Some of the large department stores with high ceilings employ 500 or 1,000-watt lamps on wide spacings. Typical show window installations employ 200-watt lamps spaced every 12 in. along the front upper edge of the window. There is a trend towards modern lighting in commercial establishments. It is utilized as an element of the interior decoration, sometimes incorporated as an integral part of the building structure in the form of luminous pilasters, glass ceilings and lighted wall panels.

Residential Lighting. Portable lamps providing artistic touches and directing the light where it is needed are the most popular domestic lighting units. General illumination by ceiling fixtures, especially in the dining room and kitchen, is recommended. Wall brackets are extensively used for decorative purposes.

Advertising. Color, motion and brilliance are obtained with advertising signs of incandescent lamps and neon tubes. A service or a product is featured by illuminated poster boards and buildings are distinctively identified by floodlighting.

Exterior Lighting. Colored and mobile illumination are provided for commercial structures by floodlights using 500 or 1,000-watt lamps. Banks of 1,000 or 1,500-watt projectors, mounted on high steel towers, light fotoball and baseball fields and such large outdoor areas as railroad classification yards. Scientifically designed street lighting using attractive equipment illuminates city streets and highways. Chicago, Detroit, Cincinnati and other American cities have recently installed super-white ways to promote the safe and expeditious operation of vehicular traffic. *See also* LIGHTHOUSES; LIGHT SIGNALS; HEADLIGHTS; SEARCHLIGHTS; ARTIFICIAL DAYLIGHT; NATURAL LIGHTING. D. W. A.

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ILLUSIONS, a phenomenon of perception due to the misinterpretation of sensory stimulation. When the sense data are not present such an appearance is known as an hallucination. The illusions of sense perception are common and have been the basis for much scepticism in regard to our knowledge of the external world. Two of the most classic instances of such illusions are found in the parallel rails which seem to converge as one looks up the track, and the stick, thrust obliquely into water, appearing to be broken. These are such common illusions that thinking corrects them without effort. As is the case where the sky and the earth seem to meet in the distant horizon. Illusions of motion may be experienced by looking out the window in a moving train. At times the landscape, rather than the train seems to be moving.

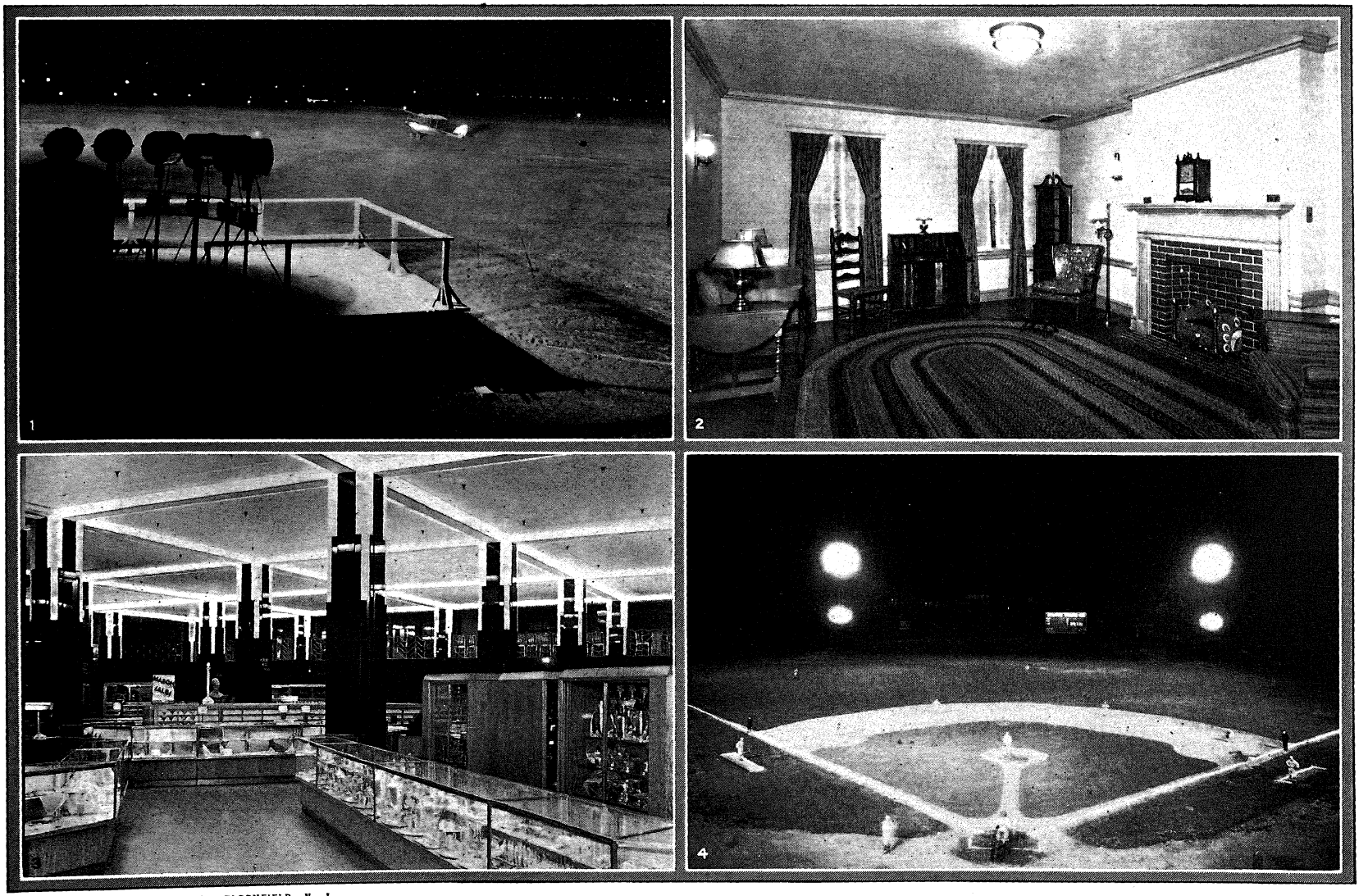
ILLUSTRATION. Coming from a Latin verb meaning to "explain," "to make clear," illustration is a word used to classify all pictures which amplify, supplement or otherwise describe a written text. Illustrations should be decorative but this is not their primary object.

Illustrations are of two kinds, those which supplement the text, and those which visually describe the



OFFERING INCENSE AND LIBATION
From the Book of the Dead (21st dynasty)

text and are extensions of it. In the first group are maps, mechanical drawings and all works of art, painting, sculpture, architecture, which cannot be described adequately by words. In the second group are such pictures as GEORGE CRUIKSHANK (1792-



COURTESY WESTINGHOUSE LAMP CO., BLOOMFIELD, N. J.

MODERN ELECTRICAL ILLUMINATION

1. Airport: Artificial lighting permits safe operation of airports and makes night travel commercially possible. **2.** Home: A central fixture, wall brackets and portable lamps make a well-lighted living room. **3.** Store: Overhead beams and columns outlined with translucent glass. **4.** Athletic field: Night baseball.

1878) drew of the Dickens characters and A. B. Frost (1851-1928) created of Uncle Remus and Br'er Rabbit.

In Western art the first example of illustrations are found on the early manuscript of the Egyptian *Book of the Dead* and the *Ani Papyrus,* now in the British Museum. There is no record of any Greek manuscripts which contain illustrations, or of Roman manuscripts before the Christian era. The only illustrations extant of the early Christian era are those for the plays of TERENCE and the book of Genesis in the Vienna Museum. These are pagan in spirit and it was not until the 11th and 12th centuries that the full force of the Christian influence was reflected in illustrations.

Scenes in miniature from the life of Christ and the saints were combined with the decoration of the



COURTESY METROPOLITAN MUSEUM OF ART

WOODCUT ILLUSTRATION OF THE 16TH CENTURY

Page from "Horae in Laudem beatissime Virginis Marie ad usum Romanum," a book of hours designed by Geoffrey Tory, royal printer to Francis I of France

page of medieval manuscripts; such illustrations belong to the art of illumination (*see* ILLUMINATED MANUSCRIPTS). But illumination as a separate art terminated in the 15th century when shadows were added in the pictures on the manuscripts.

With the invention of the printing press came the first wood engravings. The most notable are by ALBRECHT DÜRER for *Macimilian's Prayer Book* (1515), those for the *Epistle of St. Jerome* (1497) and the *Divine Comedy* (1497) and the illustrations



Il quale ſtylo fermamente infixo uno conſpicuo uaſo di Topacio ſuſtenuta, di antiquaria forma, la corpulentia ima del quale era lata, cum tumidule ſcindule cincto nella pertura mirificamente di una coronicetta, ſotto la quale era una faſciola iclauſtrata dun altra ſubiecta. Nella q̃le ligatura, in quatro æquale diuiſione, appacti erano q̃tro alati capituli di pueri ulo cũ q̃tro ſtillati ſipunculi negli labri. Da poſcia il reſiduo ſi acumina ua dua tãto, q̃to la ima corpulẽtia, in una obturatiõe ſopra loriſicio di una

A PAGE PRINTED BY THE ALDINE PRESS IN 1499

From the "Hypnerotomachia Poliphili," the work of Aldus Manutius, founder of the Aldine Press at Venice about 1499

for *Hypnerotomachia* (1499). Pictures remained extremely simple until the middle of the 16th century, often being merely outlines. At this time copper engraved plates for sword-play manuals and the younger HOLBEIN's woodcuts for the Old Testament and the *Dance of Death* were made in a less formal style. In the 17th century there were histories and a few books on topography with quaint illustrations engraved on copper; maps of the New World were covered with pictures of its flora, fauna and natives. The finest illustrations at this period were engraved by Wenzel Hollar (1607-77) for books published by Matthew Merian at Frankfort. The drawings made in 1818 by Thomas Bewick for *Aesop's Fables,* more than a century later, mark the next step.

By far the most important illustrations up to this time were those made by WILLIAM BLAKE to illustrate and illucidate the meaning of his poetry. The title-page of *Visions of the Daughters of Albion,* published in 1793, and the title-page of *The Book of*

Thel in 1789, are two of the finest examples of the art of illustration, being both explanatory and decorative.

There was little else of outstanding merit until 1830 when the modern period begins with the illustrations of John Leech (1817-64) and Cruikshank, Du Maurier and Charles S. Keene (1823-91). The outstanding American illustrators, Elihu Vedder, Howard Pyle, Edwin Abbey, Robert Blum, Joseph Pennell, Arthur Frost, F. J. Remington, Charles Dana Gibson, Maxfield Parrish, James Montgomery Flagg, Howard Chandler Christy and Rockwell Kent, belong to the last quarter of the 19th and the



COURTESY METROPOLITAN MUSEUM OF ART

WOODCUT ILLUSTRATION IN THE 15TH CENTURY

Frontispiece designed by Erhard Reuwich for Bernardus de Breydenbach's "Peregrinations in Monten Syon," printed in Mayence in 1486

first decade of the 20th century, excepting Rockwell Kent. Their work was done principally for such magazines as *Scribners, Harper's* and *Century* and for the better grade of fiction in volumes. They drew first for wood engraving and later for process engraving.

In 1870 photographs began to be used as illustrations for texts, but the technical process of making engravings did not reach perfection until 1890, and it was not until about 1910 that photography began to supplant drawings of artists as a popular medium of illustration. The photo-mechanical process is highly technical, but may be briefly described as the "etching of a design photographically transferred to a metal plate." In the third decade of the twentieth century Rockwell Kent was one of few American illustrators able to compete successfully with the work of photographers, due largely to the power and graphic quality of his woodcuts.

ILLYRIAN, an extinct Indo-European linguistic stock spoken in the general area corresponding to the ancient Pannonia and the modern Albania, Bosnia and Dalmatia. It has been preserved only in local and personal names, but enough of it is known to show that it belonged to the *satem*-group (*see* Satem-Languages) possessing affinities with Baltic, almost certainly represented by Albanian, probably akin to the extinct Phrygian, Thracian, Macedonian and Messapian, and possibly to the extinct Pre-Sabellian and Novilaran. *See* separate articles on these subjects.

BIBLIOGRAPHY.—H. Krahe, *Die alten balkanillyrischen geographischen Namen,* 1925, and *Lexikon altillyrischer Personennamen,* 1929.

ILLYRICUM, a district, not definitely defined, including all the land west of Macedonia and east of Italy and Raetia, bounded on the south by Epirus and on the north by the rivers Sava and Drave. A colony from Greece settled along the coast in the 6th century B.C., but did not seem to affect the language or customs. Among the Illyrians, a warlike, primitive people, women held a high place. Philip of Macedon conquered them, but unsubdued they turned to piracy. Rome was unable to subdue them until 168 B.C. when the southern part of Illyria was made a Roman province. By the beginning of the 1st century all of Illyria was subject to Rome and became Romanized. In 481 A.D. the Ostragoths obtained the northern part of Illyria. In the 7th century Croats settled in the western section and Serbs in the eastern. The capital of Illyria was Scodra, now Scutari in Albania.

IMAGES, representations of perception. The image is based on perception and can never be entirely removed from it. There are various types of images, such as visual, auditory, gustatory, tactile and motor. All taken together constitute the imagery that is used in connection with an act or thought. The memory image is most important for purposes of interpretation. There are also images of anticipation. James made much of these in his discussion of ideo-motor activity. The After Image is of a different character. This may be obtained by looking at a bright light and seeing the after effects when the light is turned off. The controversy over imageless thought has stimulated considerable interest in the image as a psychological phenomenon.

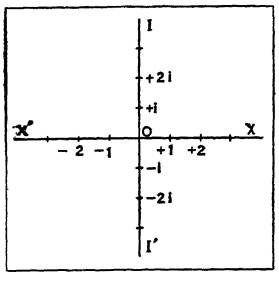
IMAGES of Christ and the saints, and even of God the Father, together with pictures (*see* Icon) were gradually introduced into the Western Church. St. Augustine deplored their veneration, but others, among them Gregory the Great, asserted that pictures were "the books of the poor" and the cult of images and pictures became popular. Even the efforts of the Frankish Church and of Charles the Great himself could not stem the tide. The question

was settled on the basis of the distinction between the adoration of God and the veneration of the images.

IMAGINARY NUMBER, a term ordinarily applied to the square root of a negative number, such as $\sqrt{-4}$, which may be expressed as $2\sqrt{-1}$. All imaginary numbers of this type may be reduced to the form $a\sqrt{-1}$ where a is a real number but not in general integral or rational; for example,

$$\sqrt{-\tfrac{1}{4}} = \tfrac{1}{2}\sqrt{-1} \text{ and } \sqrt{-7} = \sqrt{7}\cdot\sqrt{-1}.$$

Instead of writing $\sqrt{-1}$ it is the custom to use the letter i so that $\sqrt{-9} = 3i$. In the figure, if we take $X'X$ as the line on which real numbers (integral, fractional, irrational, transcendental) are represented, we take II' as the line on which imaginary numbers are represented, as shown in the diagram. *See* NUMBER; COMPLEX NUMBER.



GRAPHICAL REPRESENTATION OF IMAGINARY NUMBERS

IMAGINATION, a mental function having to do with images or ideas. In the structure of the mind it occupies a middle position between memory and thought. Thus at its lower level it runs over into the memory image, and at its higher level it develops into thought. Reproductive imagination is memory. Imagination proper is usually spoken of as creative. Among the principal types is recognized first the sensuous type, characterized by luxuriant and realistic imagery in terms of which experience is created and recreated. A person of this type lives in the world of the senses and dominantly a world of fancy and enjoys a sort of abandon and luxurious freedom from restrictions of the commonplace. It is the life of the impressionist, an effervescent life of the moment, reverberant in sensations and images.

The intellectual type is ordinarily spoken of as scientific or philosophical. Creation takes the form of propositions, theories and postulates, and the process is usually cool and deliberate. It is the most reliable and sweeping form of imagination as it deals with the largest units of thought in a logical way. The sentimental type in a good sense, often called the artistic, is characterized by its tendency to idealize experience in terms of the higher sentiments. Objects and events assume meaning with reference to remote ideals or functions such as harmony, unity, pleasure or their opposites. Experience is thought of in terms of ideals and feelings rather than of events and plans. The impulsive type lacks logic, poise and sentiment, and continuity of effort; yet it often results in great creations, as it taps the deeper resources of life under the stimulus of great emotion. But it is sporadic and is wanting in cogency and continuity. The motor type, sometimes called the practical or mechanical imagination, lacks the free play of images. It appears in persons whose interests are practical and who can foresee only as they gradually work out the situation by doing. When exercised with persistence and effort, serviceable forethought and the tendency to achieve practical success, it is one of the most valuable forms of imagination. It should not be assumed that individuals fall clearly into one or the other of these types. Indeed, all sorts of tendencies are found to blend. The best of these result in the balanced imagination, which includes the desirable elements of each type in well-developed symmetry.

It may well be said that if one has the means of appraising the type of imagination in an individual, one has a permanent insight into the character and possibilities of his personality. C. E. S.

BIBLIOGRAPHY.—J. Downey, *Creative Imagination.*

IMAM, an Arabic word meaning leader. Mohammed used the word with reference to example, or patterns of the true religion. Sunni Moslems have used imam and khalif interchangeably to designate the head of the Faith. Shi'i Moslems have applied the term to a line of leaders peculiar to themselves and constituting an Imamate as distinct from the legitimate Sunni Caliphate. In ordinary local usage the imam is the leader who stands "before" the faithful at times of common prayer in the mosque. Mohammed was the first imam, and of all his "successors" it has been required, ideally, that they be men of especially high qualifications in character, knowledge, insight and ability. The Shiites require that imams should come of the Prophet's descendants.

IMBECILES. *See* FEEBLE-MINDEDNESS; HANDICAPPED CLASSES.

IMBER, NAPHTALI HERZ (1856-1909), Hebrew poet, was born at Zloczow, Galicia, in 1856. At an early age he received a traditional Jewish education and began the life of a wandering scholar. In the Oriental lands he became familiar with their native tongues, and when he returned to Europe he settled in London where he became a collaborator of ISRAEL ZANGWILL. In 1892 he came to America, where his literary career was marked by a variety of exotic writings in several languages. Poetry and studies in mystic lore are represented in his better known writings. His Hebrew poem *Hatikwah* is a very popular anthem among the Jews everywhere. Imber died in 1909.

IMHOFF TANKS. *See* SEWAGE DISPOSAL.

IMITATION, the production of similar behavior due to the stimulus of the behavior of another. The term is used to describe uniformity of behavior, but its meaning is often confusing. Some writers have held that there is an instinct of imitation; this position, however, is no longer accepted. Because of the many similarities and uniformities of behavior, imitation becomes a probable explanation for such phenomena. But much of the activity that has hitherto been accounted for as imitation is not due to imitation; it is due to the fact that similar nervous mechanisms respond in a like manner to the same stimulus. Persons subjected to the same stimuli will often

respond in the same manner. Superficially they might seem to be imitating one another. What actually takes place is a uniformity of response, due to the presentation of a like stimulation to individuals whose nervous organization is much the same in character.

The above explanation may be specifically applied when one considers the rôle of imitation in learning. Much learning was once thought to be largely imitative in nature. In reality, only very simple acts can be learned by imitation. Unless the proper habits, the muscular coördinations and necessary skill involved in the performance of an act have been perfected, imitation is of little avail. It may give the cue, but it cannot build up the complex nerve connections involved in motor learning. Such learning requires all the effort necessary to habit formation. A surgeon who had learned by imitation would not be selected for a delicate operation. Knowledge and skill, the acquisition of which requires much more effort than the ordinary imitative procedure, would be regarded as essentials in such a case.

IMITATION, in music, an important device in contrapuntal composition. The word is popularly used as a synonym for plagiarism, but its technical significance is entirely foreign to such a meaning, for the art of COUNTERPOINT leans heavily upon imitation, while in FUGUE and CANON imitation is the heart of polyphonic writing, inasmuch as the voices, or parts, in compositions of this nature are perpetually imitating one another. Since music is a compound of three elements, melody, harmony and rhythm, three types of imitation may be classified. First, a succession of single tones may be imitated by taking the same intervals but placing the imitating part higher or lower. Secondly, a series of harmonies may be imitated by transposing the key in which they were originally set. Thirdly, a rhythmic pattern may be imitated by retaining the same time-interval between the various accents but shifting the intensity of those accents, which is syncopation. All three forms of imitation may be used together.

IMITATION OF CHRIST, THE (*De imitatione Christi*) a devotional work attributed to THOMAS Á KEMPIS (1380-1471), an Augustinian canon of the Diocese of Utrecht. First printed in 1471, but circulated much earlier in manuscript, the *Imitation* has been translated into 50 languages, and the number of counted editions is 2,000. Of all religious books it is, after the Bible, the most extensively read by ardent Christians.

The authorship of the *Imitation* has been claimed for 35 people and more than 200 books have been written on the subject. It was long the contention of the Benedictines that the author was an abbot of their order, a certain John Gerson, who is now thought to be the mythical double of another and more likely candidate, John Gerson, chancellor of the University of Paris, whose name appears on one of the earliest manuscripts. Other claimants are St. Bernard, St. Bonaventura and Walter Hilton. The learned Catholic scholar Denifle contends that the *Imitation* can only be the work of an unknown author, Dutch, however, and an Augustinian canon.

At the present time it is usually argued that the tone of the book is precisely that of a religious society to which the historical Thomas á Kempis is known to have belonged, the Brothers of the Common Life; that several of the earliest manuscripts circulated under his name; that a tradition of his authorship existed shortly after his death in his own monastery at Windesheim, and finally that internal evidence makes it probable that he was the author.

The *Imitation* is divided into four parts and consists of a series of meditations, some of which are cast in the form of colloquies between Christ and the aspiring soul. The first two deal with the pursuit of spiritual perfection, the third with the mystical experience of Christ in the soul, the fourth with the Eucharist as the supreme means of union with Christ. There is scarcely a phrase that cannot be traced to some other source, usually to the Bible, but often enough to St. Augustine or St. Bernard. Yet such supreme art of inspiration has presided over the assembling of well-worn utterances that the result is found to be unique, moving and beautiful.

Among Catholic devotees of the *Imitation* are found such unlike men as Ignatius Loyola, Cardinal Richelieu and Lamennais; among Protestants, Leibnitz, John Wesley, Gladstone; among agnostics, Maine de Biran, Renan, Matthew Arnold and George Eliot.

IMMACULATE CONCEPTION, a dogma of the Catholic Church, Greek and Roman; sometimes confused with, but carefully to be distinguished from what is commonly called the Virgin Birth of Our Lord. According to the bull, *Ineffabilis Deus,* promulgated by Pope Pius IX in 1854, the Virgin Mary herself was conceived without stain of original sin. It is the belief of Catholics that throughout her life the mother of Jesus was preserved from subsequent personal sin.

IMMANENCE, a philosophical and theological conception concerning the relation of God to the world. The immanent theory holds that God is in the world as against the view that He transcends it. Immanence in its extreme form runs over into PANTHEISM. Though THEISM may provide for the immanence of God, its more usual emphasis is upon his transcendence.

IMMANUEL BEN SOLOMON (1265-c. 1330), (called also Immanuel of Rome, Immanuel Romi, and Manoello), renowned Italian Jewish physician, poet and Bible exegete, was born at Rome in 1265 and died in Fermo, Italy, about 1330. His great knowledge embraced philology, philosophy, Italian literature, medicine, Cabala and Scholastic literature. For a time Immanuel practiced medicine at Rome, but in his later years left the city and settled in Fermo, where he wrote a Bible commentary, of which only a small portion, that on Proverbs, has been printed, Naples, 1487. Here he composed also a literary collection, entirely in Hebrew, called *Mahberoth,* 1491, consisting of erotic tales, eulogies, extravagant humor,

mordant satire, dialogue, prayers, songs and parodies. In this work Immanuel was the first Neo-Hebrew poet to employ the Italian verse form.

Immanuel's erotic tales especially are reminiscent of Boccaccio's *Decameron,* and one of the parts of the *Mahberoth,* a Hebrew composition called "Haeden Vehatofeth," "Paradise and Hell," is decidely reminiscent of Dante's *Divine Comedy.* It seems certain that Immanuel of Rome had friendly relations with the literary group to which Dante belonged. Graetz, the great Jewish historian, was the first to call Immanuel "the Heine of the Middle Ages." Immanuel wrote many poems in Italian which were highly regarded in his day; but very few of them have been preserved. Despite the purity of his personal life and his earnest religious spirit, the reading of his *Mahberoth* on the Sabbath was later forbidden, on the ground that they were of secular, not religious, character. A. Sh.

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IMMIGRATION, the movement of individuals, families, clans or races into new territory; movement from the native territory being termed emigration. Immigration has been the means by which peoples have saved themselves from famine, pestilence, war, religious intolerance and political oppression since the beginning of mankind. Until comparatively recently these factors caused movements of people in bodies sometimes including an entire race, but with the development of modern civilization nearly all migratory movements are by individuals or families.

Immigration to America has been of great proportions chiefly because of the opportunities afforded. Immigration statistics before 1820 are not available, but in that year 8,358 foreigners entered the United States. The volume increased rapidly and the annual immigration figures between 1840 and 1846 averaged 90,000. During the next eight years, the annual immigration ranged from 250,000 to 400,000. Immigration slackened temporarily during the Civil War, but increased steadily thereafter. Between 1881 and 1890, 4,300,000 immigrants were admitted, but the volume of the influx was again checked by the financial crisis of 1893. Following the economic recovery of the country the figure again increased amounting to more than a million in the year 1905. In 1907 it was 1,285,000, the largest in any single year, and the total for the decade 1901 to 1910 was 5,600,000. During the next decade war troubles reduced the number of immigrants to a total of 3,100,000. In the last decade the influx has been greatly curbed by strict immigration legislation so that the total for the ten years from 1921 to 1930 has been less than 2,500,000, despite a tendency for foreign peoples to come to the United States to escape post-war troubles at home.

The first immigration problems of the country began to develop after 1880. Prior to that time the immigrants came almost entirely from northern and western Europe, principally from the British Isles, Germany and the Scandinavian countries. This immigration, known as the old immigration, was composed of peoples who were ethnologically the same as the people already in the United States. After 1880 the immigrant flow shifted from northern and western Europe to southern and eastern Europe, bringing over Italian, Slavic and Oriental peoples instead of the Anglo-Saxons and Teutons. This new immigration, being ethnologically different from the old, was difficult to Americanize and absorb into the existing population. Furthermore, a certain element of race hostility existed between the old and new immigration, and American laborers objected to competition by cheap foreign labor with its low standards of living. By 1915 the new immigration had increased and the old immigration decreased until the former made up 79% of the total.

Prior to 1917 the only steps taken to restrict or control immigration were the exclusion of undesirables by the Immigration Act of 1882 and the exclusion of immigrants brought over as contract labor by the Allen Contract Labor Law of 1885. In 1917 an act was passed prohibiting the entry of illiterate immigrants over 16 years of age. This proved ineffectual and in 1921 a temporary act was passed which limited the number of immigrants to 3% of the number of the respective nationalities comprising the population as per the census of 1910. In 1924 the Johnson Act reduced the percentage from three to two and changed the basis on which the number was calculated from the 1910 census. The effect of the Johnson Act was to permit the entry of only 17,680 immigrants from southern and eastern Europe annually, and 140,799 from northern and western Europe.

Particularly troublesome has been the immigration of Asiatics. In 1860 there were some 20,000 Chinese in the country, mostly in California, and race prejudice and economic difficulties arising from this extremely cheap labor brought about a series of legislative measures and treaties excluding Chinese labor. The influx of Japanese a little later, reaching 111,000 in 1920, was even more serious. The problem was partially solved by a gentlemen's agreement with Japan by which she limited the passage of laborers. Both the Chinese and Japanese immigration was excluded by the Johnson Act.

IMMORTALITY, the survival of the individual soul after death. Although immortality may be regarded in several ways, such as living on in the memory of others or through one's works, or in the continuity of the germ plasm through one's posterity, it is the question of personal immortality that has created the most interest. No doubt much of the longing for immortality has been due to the fact that existence on this earth for the mass of mankind has not been all that the heart could desire by any means. Belief in immortality has been one of the great compensations through the ages. Immortality is not so necessary when life has yielded some satisfaction. With the improvement of man's earthly lot his yearning for immortality may diminish and the belief lose its former interest. Indeed there are signs that such is taking place at the present time.

Plato found it necessary to postulate immortality in order for knowledge to be at all possible. Cognition is re-cognition. The soul in recognizing ideas is but beholding forms it has already become familiar with in some previous existence. From a previous existence it is easy enough to argue to a future one. Kant also found it necessary to postulate immortality but for a different reason. For him it was a necessary presupposition of the moral life. Desire and reason were so at odds with one another that it was only in endless existence that they could ever come together. There was no hope for such a happy event ever taking place in a finite time. Morality presupposes freedom and immortality. Thus by the very conditions of the moral life Kant was able to save all these values which seemed to be lost to the phenomenal world.

When the soul was regarded as a substance it was as easy to believe in immortality as in the indestructibility of matter. But modern psychology is essentially a psychology without a soul. The problem for immortality is that of whether psychological states are so dependent upon physiological conditions that they cannot exist independently of body functionings. That there is a definite connection between body and mind has been well established. Mental states cannot and do not exist in a vacuum.

One of the most ingenious possibilities for immortality has been put forth by William James in his little essay on *Human Immortality*. James argues that we are functions of the cosmos, and that when the bodily functions cease it is possible that some other link may come in and do the work that had hitherto been done by the body.

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IMMORTELLE, the French name sometimes applied to various plants more commonly known as EVERLASTING. The flowers, which retain their form and color for a long time after drying, are used for funeral wreaths and winter bouquets.

IMMUNITY, the resistance of an organism to invasion of its tissues by micro-organisms or by products of their growth. Immunity may be natural, in which case the host possesses resistance to the invader at the time it first enters its body; or it may be acquired, by which is understood a resistance developed directly or indirectly after the invader has entered. Acquired immunity has a tendency to persist after a victorious combat with an invading organism, and may endure for life. Immunity may be acquired directly by the development within the host's own organism of immunizing substances called antibodies as a result of stimulation by proteins developed by the invader which are called antigens. This type is exampled by vaccination against smallpox, since living bacteria are introduced. But in another type the bacteria may be dead, a fact utilized in protecting against typhoid fever. They may be utilized even when disintegrated, or the filtrate from the medium in which they grew may be injected, and antibodies produced. The soluble toxins or poisons from the diphtheria are thus employed in preparation of diphtheria antitoxin.

Immune substances developed in this way are found in the tissues, but also circulating in the blood, dissolved in the serum. For example, if a horse be immunized against diphtheria, its blood serum may be injected into a child to protect it from an attack of diphtheria. This is *passive immunity.* (*See* SERUM THERAPY.)

The immune properties of sera may be manifested by their ability to neutralize a toxin directly, to cause specific living bacteria to clump together (agglutinins), to precipitate a protein antigen (precipitins), or to stimulate leucocytes to attack bacteria (opsonins). (*See also* VACCINATION; ANTITOXIN; ALLERGY; BACTERIA; DIPHTHERIA.)

IMMUNIZATION AGAINST DISEASE. *See* CHILDREN, DISEASES OF.

IMPEACHMENT, a criminal proceeding against a public officer before a legislative tribunal. In England impeachments are brought by the House of Commons and heard by the House of Lords, and are not confined to public officers, a commoner being impeachable for treason, and a peer for any crime. In the United States they are brought by the House of Representatives and tried by the Senate. State constitutions usually make similar provisions, but in some states judges of the highest court are joined with the Senate as a court of impeachment, and in others impeachments are heard before the highest court. It is generally provided that only public officers shall be impeachable, and they only for high crimes and misdemeanors.

IMPEDANCE, electrical, that property of a circuit which opposes the flow of current and is the combined effect of RESISTANCE and REACTANCE. Its value is given by the equation

$$Z = \sqrt{R^2 + X^2}$$

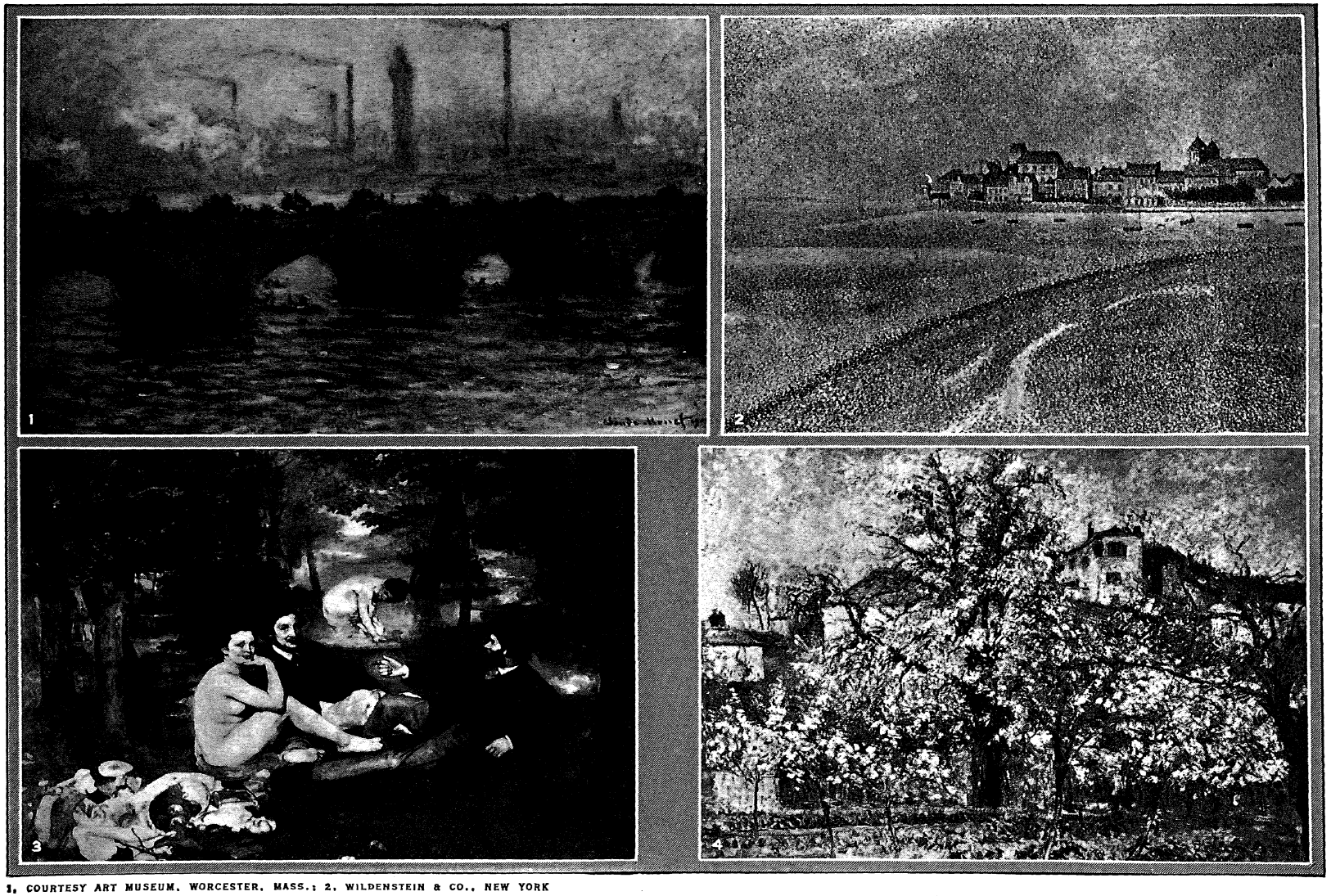
where Z is the impedance, R the resistance and X the reactance. The ohm is the unit of impedance.

IMPERIA, a city of northwestern Italy, capital of the province of the same name, formed in 1923 by the union of the two cities, Porto Maurizio and Oneglia, on the Gulf of Genoa. Imperia has a nautical school, an academy, library and theater. The chief occupations are the cultivation of olives, fishing, and the exportation of wine, olive oil and fruit. The city is a popular seaside resort. Pop. 1931, 28,627.

IMPERIAL FEDERATION LEAGUE. *See* BRITISH COMMONWEALTH OF NATIONS.

IMPERIALISM. The older imperialism meant the enlarging of the domain of a state beyond its national and racial boundaries, and the subjugation in consequence of weaker alien races. It was for the most part due either to the personal ambition of an individual, a Napoleon or a Caesar, or the dynastic ambition of a family, the Hapsburgs or Romanoffs.

Although the desire of certain idealistic groups to advance the welfare of mankind has undoubtedly played an important rôle in modern imperialism, nevertheless the driving force in contemporary imperialism has undoubtedly been the desire of strong



1, COURTESY ART MUSEUM, WORCESTER, MASS.; 2, WILDENSTEIN & CO., NEW YORK

IMPRESSIONISM IN FRENCH ART

1. "Waterloo Bridge," by Claude Monet (1840-1926). **2.** "Paysage: le Crotoy-Amont," by Georges Seurat (1859-91). **3.** "Dejeuner sur l'Herbe," by Édouard Manet (1832-83). In the Louvre, Paris. **4.** "The Kitchen-Garden: Trees in Blossom," by Camille **Pissarro (1831-1903).** In the Luxembourg, Paris.

industrial states to gain exclusive markets for their manufactured products and control of the sources of raw materials for their factories. Africa, India and China have consequently been arenas of imperialistic aggression.

The modern imperialist contends that, whatever his immediate personal motive, he is in fact conferring the blessings of western civilization upon benighted peoples, and that he is definitely contributing to the further development of that civilization through the exploitation and exploration of the "backward" places of the earth. In his contention there is probably a large measure of truth. Nevertheless, it must be remembered that the unregulated imperialism of recent decades has also been responsible for ruthless human exploitation, for intense colonial rivalries and heavy armaments, and that it bears, in part at least, responsibility for the World War. S. C. W.

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IMPERIAL MOTH, one of the largest species (*Basilona imperialis*) of the royal moth family (*Citheroniidæ*), and one of the largest of North American insects. The adults may have a wing expanse of more than 5 in. They are rich canary yellow in color, with large irregular blotches and markings of pinkish purple. The caterpillars have hairy bodies, and vary greatly in color and markings. Some are green, some black, others have brick-red patches. Near the head are four short horns. When full grown they are often 4 in. in length. They feed on the foliage of hickory, butternut, oak, elm, maple, spruce, pine, juniper, hemlock, sassafras and sweet gum trees. They pupate in the ground.

IMPERIAL PREFERENCE, the practice among the possessions of Great Britain of reducing or exempting duties on imports when trading with one another, and also when trading with Great Britain.

IMPERIAL VALLEY, a former desert region now highly productive, situated in Imperial Co., southeastern California and extending into Lower California in Mexico. It covers an area approximately 110 mi. long and 40 wide in the southern part of the Colorado Desert. Most of the valley is below sea level. In past geologic ages it was a delta of the Colorado River and the soil, which is of an unexcelled and apparently inexhaustible fertility, is a fine silt deposited by the river. The miracle of irrigation made its first appearance in Mar. 1902 when the California Development Company completed the Imperial Canal bringing water from the Colorado River near Yuma. The valley immediately began to blossom and farmers in large numbers moved into the region. In 1905 came disaster due to the insufficient control gates on the Colorado and unusually high water. The river broke through its bounds and again as in past ages flowed into the Salton Sink. The inundation was not finally stopped until Feb. 11, 1907. Adequate levees to prevent a recurrence have since been constructed.

The climate of Imperial Valley is famous for its excessive extremes of temperature, a change of 60° in 24 hours being not unusual. The temperature ranges from a minimum of 24° to a maximum of 125° with a yearly average of 71°. The annual rainfall varies from 1.5 to 3 in. and the resultant lack of humidity makes the heat endurable. The warm climate and preponderance of sunshiny days give a long and remarkably rapid-growing season. Two or more crops a year are commonly produced from the same field by careful rotation. As many as 10 cuttings of alfalfa, with 6 of them commercially profitable, can be grown. Imperial Valley is the United States's chief source of certain winter vegetables. In 1930, 38,100 acres planted to early lettuce produced 4,267,000 crates valued at $7,344,580, which amounted to 70.5% of the early lettuce crop of the United States and over 1/5 of the crop for the entire year. Also in 1930, 5,752,000 crates of early melons, value $7,592,640, were shipped out of the Valley. During that year Imperial Valley produced 96.7% of the early or 37.3% of the entire melon crop of the United States. Texas with 113,000 crates was the second producer of early melons. Other important crops are alfalfa, cotton, asparagus, onions, grapes, oranges and dates. Between 1910 and 1920, the population of Imperial Co. made a phenomenal increase of 219.7% or from 13,591 to 43,453. The population in 1930 was 60,903. The chief towns are Calexico, El Centro, Imperial, Holtville and Brawley.

IMPERIUM, the supreme power, civil and military, including that of life and death, held by dictators, consuls, praetors and others in command of an army or province, or by private individuals to whom it had been delegated by a special law in time of stress. The power conferred the right to take the auspices, convoke the senate and other assemblies, to issue edicts, treat with other nations and exercise criminal jurisdiction. Within the city and one mile outside it was subject to appeal; beyond that limit it was absolute.

IMPHAL, capital of the native state of Manipur, in Assam, India. The city consists of a group of villages clustered around the rajah's palace. It is connected by a cart road with Kohima and the Brahmaputra Valley. Commerce is carried on almost exclusively by women, the chief products being rice and silk. Pop. 1921, 80,003.

IMPLEMENT SHELTERS are sheds for protecting field machinery from the weather when not in use. The frame is generally light, and vertical boards and battens or corrugated metal are used as covering. Trusses are usually used to support the roof to provide a clear floor space. The front may be open or provided with a series of doors to permit storing implements without shifting those in place. Space is often provided for shops and seed lofts.

IMPORTS. *See* Exports and Imports.

IMPORTS, INVISIBLE. *See* Exports, Invisible.

IMPOSITION, in printing, the task of placing forms in position for the lock-up. The considerations for margins, trim, best use of stock, favorable conditions for presswork and later working of the sheet comprise the main functions. Forty or fifty important

major schemes are in use, with several hundred variations and schemes of lesser importance. Forms of double 16's and 32's and quadruple 16's are most frequent in book work.

IMPOST, any tax or tribute, but the term is generally used as synonymous with indirect tax, particularly on imported commodities.

IMPOST, in architecture, the stones whose upper sides form the bed from which an arch springs. In many Etruscan examples the imposts were ornamented with moldings or carvings, and during the Roman period it became almost the universal custom to mold the imposts with a series of moldings, often recalling the Doric capital. The Renaissance codifiers, Vignola, Scamozzi and others, attempted to develop a standard type of impost molding to accompany each order, but in the actual buildings, both Roman and Renaissance, there is much variety.

IMPRESSIONISM, in painting, a movement inaugurated by a school of late 19th century painters, chiefly French, whose interest lay in the rendering of fugitive impressions made upon the eye in a limited time, with little interest in the subject matter as such. A journalist, viewing an exhibition of these artists in the *Salon des Refusés* in 1863, nicknamed them the *Impressionistes* after a picture by Claude Monet, entitled *Sunset, an Impression,* and the designation at once became popular.

The Impressionist Movement was originated by Edouard Manet (1832-83), who had been influenced by Courbet and Corot. (*See* Realism.) Manet gained much from a study of the Japanese color prints which had recently been brought to Paris, but his methods were taken more deliberately from Rembrandt and Velasquez. These methods he simplified and emphasized. Notably he made color take the place of dark shadows, often eliminating shadows even where they naturally fall. Design itself he built up out of light in combination with color. Manet's methods, together with his use of contemporary, unidealized subjects, as in *Le Déjeuner sur l'herbe* and *Olympia,* angered the public, but attracted the interest of a group of insurgent young artists. One of the greatest of these was Claude Monet (1840-1926), whose visits to England had familiarized him with the painting of Turner. Full of light and gorgeous color, Turner's work impressed Monet deeply. He became the leader of the *plein air* section of the Impressionist Movement, which was called Luminism, a term expressive of the pulsating quality of light which this particular group of Impressionists strove to render. The Luminists recognized color purely as the reflection and refraction of light, which, passing through the medium of varying atmospheric conditions, produced particular and evanescent effects of sunlight upon the same object at different seasons or hours of the day. Through a new technique they were able to record hitherto unrecognized and illusive aspects of Nature, and through their work a new visual perception was developed. Monet, for example, made it possible for colors no one saw in Nature to be commonly recognized; violet tones were seen on weathered wood surfaces, in the depths of snow and in the lengthening shadows on hillsides at the close of day.

The four essential factors in Impressionistic technique are: 1. By painting spots or brush strokes of complimentary colors side by side at the proper distance, a strangely luminous and vibrant effect is produced; 2. Atmospheric effects, as obtained by Masaccio, the 14th century Florentine painter, can be developed by the use of light in combination with bright color to achieve a visible haze or glow. 3. Broad brush strokes of single color when viewed at a distance give a greater sense of reality then that obtained by detailed painting, a method borrowed from Velasquez; 4. Light may be used in a threefold combination: as a suffused color haze or veil over the entire picture to create the illusion of perspective, as a flooding of the canvas with sunlight, or as a focusing device to accent the glow of a color. Variations of these, such as Divisionism, were developed by Pissarro into Pointillism, which consisted of covering the entire surface of the canvas with minute spots of pure color in juxtaposition, interspersed with points of white; a pointillistic canvas, when blended by the eye at the proper distance, suggests a mass quivering with light and vibrating color. This method, as used by Seurat, brought unusual results.

Among the best-known artists of the Impressionistic Movement were Manet, Monet, Cézanne, Pissarro, Sisley, Renoir, Degas, Carrière and Besnard. The movement was led in England by Whistler. In America Impressionism was introduced by Theodore Robinson, a pupil of Monet, but was strongly opposed. Childe Hassam, however, by a skilful adaptation reconciled the methods to meet the essential characteristics of the American landscape school and stands as its chief exponent. Other American artists who have incorporated the technique into their work are Redfield, Twachtman, Lawson, Weir, Glackens, Prendergast, Schofield, Yates and Symons. *See also* Post-Impressionism and Cubism.

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IMPRESSMENT AND SEARCH. A grievance of the United States against Great Britain which eventually became a leading cause of the War of 1812 was the British practice of searching foreign merchant vessels, seizing British seamen thereon, and impressing them into the service of the British navy. Similar impressment was practiced in England to augment the volunteer forces of the army and navy. The hardships of British naval service had driven many thousands of British seamen into the American merchant marine. Many American seamen were of British birth, and British officers sometimes negligently or deliberately impressed American citizens. The extent of this abuse is suggested by the fact that at the beginning of the War of 1812 2,000 "British" seamen were placed in prison ships for their

refusal to fight against the United States; but a Department of State report, forwarded to the Senate by President Madison in justification of his attitude, which gave particulars of 6,057 cases of impressment, was investigated by the Massachusetts House of Representatives and found "extravagantly exaggerated."

IMPRISONMENT, deprivation of liberty against the will of the one imprisoned. It is not confined to incarceration but includes any forcible involuntary detention in any place. It is not necessary to lock up or even touch a person, provided he is so threatened that he yields to the restraint through fear.

IMPULSE OF A FORCE, the product of the FORCE and the time. To produce a measurable acceleration (*see* VELOCITY) in a mass, it is required that the force applied act for a measurable interval of time. The motion of a body, acted upon by a force, will depend upon the magnitude of the effective force acting upon it and the time during which the effective force acts.

Since a force is the product of mass, M, and acceleration, a, or $F = Ma$, the equation, $Ft = Mat = Mv$, may be written, where v is the velocity of the body. The product, Mv, is called the *momentum* of a body. To give a body a large momentum requires a large impulse. By the same token, it takes a large impulse to reduce a large momentum to zero, i.e., to bring a body to rest.

The impulse of a force to produce rotation is dependent not only upon the impulse of the force acting but also upon the distance between the axis of rotation and the point of application of the force. Hence, *rotational impulse* $= Frt$, where Fr is the moment of the force acting $= L = I\alpha$. Here I is the moment of inertia and α is the angular acceleration of the body. Therefore,

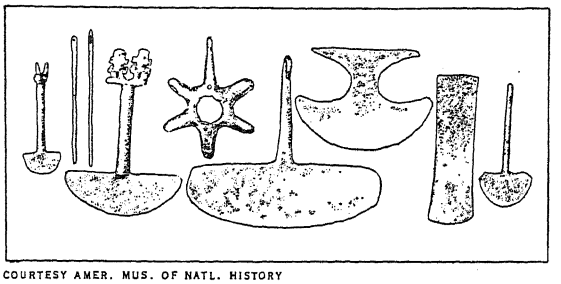
$$Frt = Iat = I\omega,$$

where ω is the angular velocity and $I\omega$ is the angular momentum of the rotating body and is to rotation what mv is to motion of translation. S. R. W.

INAGUA, or Great Inagua, an island of the West Indies, belonging to the group known as the British Bahamas, lying off the southeastern coast of Florida. Inagua is the most southern of the group. It is 50 mi. long and has a maximum breadth of 25 mi. The surface is flat and offers rich pasturage. Salt is the main product. The largest settlement is Mathew Town. The island is sparsely populated, having, in 1931, with Little Inagua, 667 inhabitants. Little Inagua lies 10 mi. to the north and is about 10 mi. in length and 6 mi. in breadth.

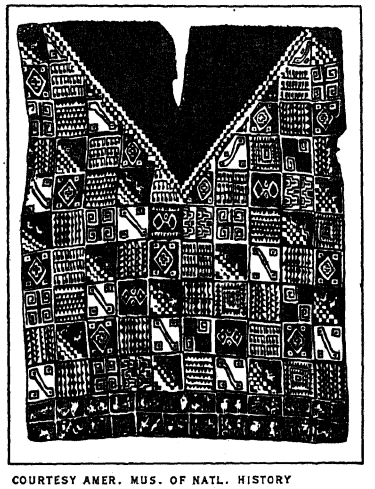
INAUGURATION, the formal assumption of office by a chief executive of nation, state or city. In the United States, inauguration day is Mar. 4, the Constitution having provided that Congress should assemble after the first election on the first Wednesday of Mar. 1787, which was the fourth of the month. A bill was passed to change the date to Jan. 20, and this had been ratified by seven states in June 1932.

INCA, formerly one of the most important and powerful peoples of South America, inhabiting an extensive territory which included Peru and a large part of western South America. Being skilled in war and agriculture, they extended and developed their lands until the Inca empire became one of the greatest nations on the continent. Up to the time of the Spanish Conquest (*see* PERU, HISTORY OF), they had reached a high level of civilization, encouraging the arts, building impressive temples and buildings, and governing with wisdom and justice. Primarily agricultural, the Incas raised grain, cocoa and cotton, and employed an excellent irrigation system. They worked many handsome ornaments in precious metals decorated with valuable jewels, and excelled in the manufacture of pottery and woven cloth. In religion, the Incas were



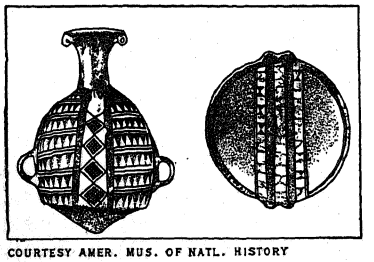
COURTESY AMER. MUS. OF NATL. HISTORY

INCA IMPLEMENTS OF COPPER AND BRONZE



COURTESY AMER. MUS. OF NATL. HISTORY

INCA PONCHO FROM THE ISLAND OF TITICACA



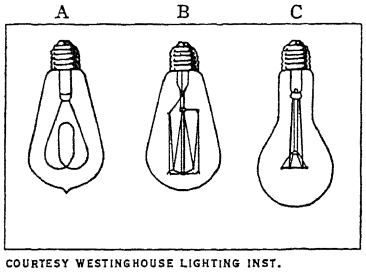
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TYPICAL INCA FORMS IN POTTERY

sunworshippers, the king being the deity's representative on earth and therefore the supreme power. Cuzco was the capital of the realm and the seat of the established religion. Here, as in other parts of the empire, were erected imposing temples and palaces of which only ruins remain to-day. The Inca civilization collapsed after the conquest of the country by Francisco Pizarro in the 16th century.

INCANDESCENT LAMPS, essentially, glass-enclosed filaments, which are heated to incandescence by the passage of an electrical current. The basic principle of incandescence as produced by electricity was discovered by Sir Humphrey Davy at the beginning of the 19th century. The late Thomas A. Edison is generally credited with the development, in 1879, of the first commercially successful incandescent lamp, employing a long, thin filament of carbon enclosed in a glass bulb from which the air had been exhausted.

Subsequent improvements have been toward the use of other materials which withstand high temperatures



COURTESY WESTINGHOUSE LIGHTING INST.

INCANDESCENT LAMPS

A, *Carbon vacuum lamp;* B, *vacuum Mazda lamp,* C, *gas-filled Mazda lamp*

better than carbon. Rare metals, such as iridium, osmium and tantalum, were used, but tungsten proved to be the best and has been in general commercial use since it was first introduced in 1908. Since 1914 the bulbs of the larger lamps have been filled with an inert gas, nitrogen or argon, which retards the disintegration of the filament, while the smaller ones are evacuated. At present, the 40-watt size is the smallest for which a gas-filled bulb is economical. More than 350,000,000 large and 250,000,000 miniature incandescent lamps were sold in the United States during 1930. *See also* Electric Lamps. H. S. B.

BIBLIOGRAPHY.—W. Kunerth, *Textbook of Illumination;* Howell and Schroeder, *The History of the Incandescent Lamp;* M. Solomon, *Electric Lamps.*

INCANTATIONS, words originally intended to be chanted, in connection with the operation of a magic charm or spell. This represents a belief in the mysterious power of words, often in connection with ceremonies, to bring on good fortune or avert disaster, but particularly to bring evil to one's enemies. Blessings and curses are allied to incantations, as are the formulae of Exorcism.

Incantations combine with religious doctrines and survive in folk-lore. Thus a German formula to staunch blood is: "Blood stand still, as Christ stood still in the river Jordan." In performing a ceremony to secure good crops, to obtain a husband, to cure a rupture, or whatever the occasion, in addition to the proper rite, the proper words must be spoken with strong faith. *See* Witchcraft.

INCENDIARY MIXTURES, substances used to set fire to buildings, ships, aircraft and other material, comprising a combination of chemical materials that will ignite and burn with an intense flame. A number of materials may be used, but there are only two main types of mixtures. The first and more simple one comprises a mixture of an inflammable material, such as resin or pitch, with an oxidizing agent, such as potassium nitrate. This type, on ignition, produces a large volume of flame for a considerable length of time. The second type scatters very hot molten substance by means of a mild bursting charge. The substances of this class usually consist of aluminum and iron oxide which react to form iron and aluminum oxide on ignition, producing an intense heat as high as 2500° C. This latter type is suitable for use in incendiary shells, being ignited by a fuse upon reaching its destination and scattered by a small bursting charge of powder.

INCENSE CEDAR (*Libocedrus decurrens*), a resinous-aromatic evergreen tree of the pine family, found in high mountains from northern Oregon to Lower California. It grows ordinarily 80 to 100 ft. high, but occasionally rises to 150 ft. The straight trunk, 3 to 7 ft. in diameter at the base, with bright cinnamon-red bark, bears slender branches, forming a graceful, feathery crown. On the flattened branchlets are borne sprays of arbor-vitæ-like leaves. From the flowers, which appear in January, develop small pendulous cones, ripening in autumn. Because of its rapid growth and elegant appearance, the incense cedar is planted in the Middle Atlantic States and in Europe as a decorative tree. The durable, reddish-brown, fragrant wood is used for furniture and various other purposes. It is cut for lumber chiefly in California; the total cut in that state in 1927 exceeded 30 million board feet valued at the mill at upwards of $700,000.

INCEST, sexual intercourse between a man and a woman related to each other within degrees wherein marriage is prohibited by statute. Statutes vary in different localities. Consent is necessary, although in some states a man may be punished even if the woman did consent. At common law it is not an indictable offense.

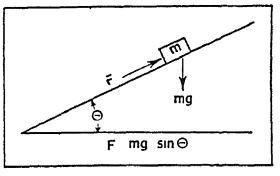
INCH, a unit of linear measure equal to the 12th part of a Foot; it is equivalent to 2.54 cm. In measuring rainfall, an inch is equivalent to 0.62338 gals. of water per sq. ft. "Inch" is derived from the old English word "ynce," in turn derived from the Latin "uncia," a 12th. In 1266 it was established as the length of 3 barleycorns by English statute.

INCINERATOR. *See* Refuse Disposal.

INCLINATION, MAGNETIC. *See* Magnetic Dip.

INCLINED PLANE, in mechanics, a smooth plane which intersects a horizontal plane at an angle

less than 90°. The force required to hold a body in equilibrium on a frictionless inclined plane is the product of the weight of the body, *Mg* (mass times the gravitational constant), and the sine of the angle of inclination, θ, or *Mg.* sin θ (see figure). The mechanical advantage is 1/sin θ. The SCREW is a spiraled inclined plane.



INCLINED PLANE

INCLINOMETER. *See* DIP CIRCLE.

INCOME, in economic theory, a term to indicate wealth as measured in MONEY and as acquired by an individual or community in a set period of time, such as a year. The social income is the sum total of individual incomes. Real income is generally defined in economic theory as the sum total of the services and commodities for which money income is expended. Yet even here economists often make a logical distinction. When the commodities purchased are not immediately consumed or at least not consumed during the income period under discussion, these commodities really constitute investment and savings of income rather than real income. Thus the money income is divided between the fraction expended within the income period and the fraction saved or invested. The money income of a business is defined as the net returns measured in money for the net product of a business during the income period. Increasing the net product would normally increase the money income subject to the regulating control of the laws of SUPPLY AND DEMAND. The conclusion is drawn that the total real income and the total net product of business tend to an equilibrium and ultimately become as a matter of fact equivalent quantities. There now emerges the problem of the precise relations between the net product, the money income and the real income. The problem is complicated by the position of WAGES in the scheme, for wages are apparently both an element of the gross product and also a form of money income. Some economists, however, use the terms money income, real income and net product as all practically interchangeable from the standpoint of industrial society as a whole.

INCOME BONDS depend for the payment of interest upon the earnings of the issuing company. They rank just above PREFERRED STOCK. All fixed charges of the corporation must be met out of its earnings before payment of interest. The income bondholder therefore, has no right to sue for unpaid interest unless it has been earned. The bonds are cumulative or non-cumulative, interest being declared by the directors as in the case of stocks. Income bonds as a rule grow out of railroad reorganizations when holders of defaulted mortgage bonds accept them of necessity. The principal and interest may be secured by mortgage but such mortgage is a lien after all other bonded indebtedness and fixed obligations. The interest on such bonds does not constitute a fixed charge. *See* BONDS.

INCOME TAX, a form of taxation levied on net income. The income tax occupies a preeminent position in the fiscal system of some national states, notably Great Britain, Germany and the United States; and a useful though as yet a subordinate position in certain of the American states. Although by no means a new form of TAXATION, it has risen to this outstanding position only in comparatively recent times. In Great Britain the income tax supplies somewhat more than one-third of all revenues, while it constitutes the source of almost one-half of the United States Federal revenue. In none of the American states does the proportion rise as high as one-tenth of all state and local revenue.

Income tax laws differ so widely at practically every point that no standard practice of income taxation can be discerned. The two points which are most nearly common to all income tax legislation are the exemption of a certain amount of income to each taxpayer and the application of progressive rates to the remainder. Income tax laws in the United States have tended toward higher personal exemptions, with a resultant rapid shrinkage of the number of persons subject to this kind of tax. Progression in rates is not universal, however. If the tax is regarded a personal tax, levied against the person on account of his personal ability to pay taxes, the rates are usually graduated. If the tax is levied on the income from designated sources, the use of progression is infrequent, although the rates may vary according to the source of the income.

The first problem of income taxation is the determination of taxable income. Tax laws usually avoid definitions, and enumerate certain forms of receipt which are declared to be income, other receipts are excluded, for purposes of the tax. The stereotyped language of the Federal law, awkward and misleading as it is if taken literally, has been followed by a number of states in order to avoid unnecessary misunderstanding by taxpayers subject to both state and Federal tax. The purport of these statutory definitions is that the tax shall be levied upon net income.

The income tax presents ample opportunity for double taxation in the absence of a uniform method of determining the tax liability. Each state or nation taxes, first of all, its citizens, and usually, also, its residents, on their entire income from all sources. If in addition, non-residents are taxed on the income derived from sources within the state, double taxation of such income inevitably occurs when the state of which these aliens are citizens also taxes income, unless there is reciprocity, or provision for crediting taxes paid in the other jurisdiction. This aspect of income taxation is the subject of special study by the fiscal division of the League of Nations, and by a committee of the National Tax Association.

Differentiation in the source of income is given recognition under the laws of Great Britain and the United States. In the latter, certain amounts of income are designated as earned income and the taxpayer is allowed a credit of 25% of the tax levied

against such income. Earned income is supposed to be that received for personal services, in contrast to income property, which is by definition unearned. This distinction is not self-evident, especially if the income is a joint product of LABOR and CAPITAL, and the law necessarily falls back on arbitrary distinctions to establish the change required for purposes of the tax credit.

There is a certain confusion regarding the status of the corporation under the income tax. If the corporation is a separate legal indentity, it should pay income tax as natural persons do, and the latter should be required to include dividends with other income. If, however, the separate identity is faded out, and the corporation is regarded merely as a channel through which income flows it should not be taxed separately under the income tax. Stockholders are quick to contend that they are the corporation when the question of taxing dividends is to the fore, but equally as quick to insist on complete .corporate identity when it is a question of the corporate liabilities. The Federal law does not meet this problem satisfactorily since it imposes a heavy tax on corporate income, but exempts dividends only to the extent of the very moderate rates of the normal tax.

The proper solution would appear to be to tax corporations under a business tax, at a moderate rate, and to regard the income tax essentially as a personal tax, applicable to personal incomes.

Economic Aspects of the Income Tax. The key to the economic significance of the income tax is found in its incidence, i.e., in the manner in which its burden falls. The tax on personal net income is borne by the person who pays it. The tax on corporate net income tends to fall ultimately on the common stockholder. In the case of regulated monopolies, this tax, like all others upon such corporations, may be transferred to consumers through advances in rates. Whether this actually occurs in any rate increase will depend on the proximity of the previous rate level to the point of maximum net return.

This certainty of incidence suggests a clear line of policy in income taxation. Heavy taxes on corporation net income reduce the stockholders' return, or in any event their equity, and thus may discourage investment. It tends to sour their attitude toward the government and the business. On the other hand, heavy taxation of personal incomes, in which dividends are blended with the income from all other sources, is simply heavy taxation. It has no adverse association with business. If such a tax is graduated, it tends to distribute the tax burden according to personal ability to pay. It may be distasteful, even unpopular, but it has no such objectionable psychological effect as heavy taxation levied directly on the net income of the business unit.

If the taxation of personal incomes at progressive rates is carried too far, the flow of savings into investment may be diminished. This result would come more quickly under heavy taxation of the corporate net income, since the yield on investments is directly and obviously impaired. The tax on personal income does not impair the investment return; it simply reduces the individual's purchasing power.

Business income is sometimes heavily taxed because this is a simple method, from the administrative standpoint, to get revenue. A more scientific, more equitable and at the same time a less discouraging plan of income taxation is to regard the individual incomes as the chief object of income taxation, while restricting the income tax, as applied to corporations, to the net income not distributed to stockholders.

H. L. L.

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INCONVERTIBLE PAPER CURRENCY. *See* FIAT MONEY; MONEY.

INCREASING RETURNS. *See* DIMINISHING RETURNS.

INCUBATION, the process of maintaining, by natural or artificial warmth, the even temperature required to hatch eggs or to develop bacteria. In medicine, the term applies to the period between the contracting of a disease and its actual outbreak. Artificial incubation is used in poultry raising, in bacteriology and for prematurely born human infants. Although successfully carried on in ancient Egypt and China, practical modern devices date from about 1877.

Nearly all birds incubate their eggs, although in some cases vegetable decomposition is used to furnish warmth. The megapodial birds of the Australasian Islands deposit eggs vertically in mounds of decaying vegetable matter and chicks emerge strong enough to take flight immediately. Most birds however build nests to protect their eggs, the female usually incubating them until the young emerge. Sometimes male and female alternate in brooding. A few parasitical birds, like the cuckoo, lay eggs in the nests of other birds where they are incubated usually at the expense of those rightfully laid there. The period of incubation varies from about 10 days, as for the wren, to 50 or 60 days, as for ostrich eggs. Oviparous snakes leave their eggs exposed to moist heat, except for the pythons, which incubate by coiling on their eggs.

INCUBATORS for hatching eggs, comprise a box-shaped, heat-insulated, wooden chamber in which the egg tray is placed; a source of heat, generally a special kerosene lamp; a thermo-regulator for keeping the temperature uniform; and a thermometer. Special devices are sometimes provided for turning the eggs. The capacity of incubators varies from a few dozen to several hundred eggs.

INDEMNITY, in international relations, a form of money compensation paid by one STATE to another for loss, damage or injuries sustained. A state must use reasonable diligence to prevent injuries to other states by its own nationals (*see* CITIZENSHIP), or by ALIENS residing within its territory. REPARATION must be made for breach of duty, but the payment of an indemnity is deemed sufficient. China was compelled to pay indemnities to the Powers for damages growing out of the BOXER REBELLION. C. E. MA.

INDEMNITY, LEGAL, the protection from loss or damages, or the liability thereto. Contracts of indemnity often take the form of bonds. The purpose and effect of such contracts is to save the indemnitee from liability or loss upon some past or future obligation running to or from a third person. Dependent on the terms of the contract of indemnity, the indemnitor may be required to indemnify his obligee, even though no actual loss or damage was sustained. For illustration, should a party be indemnified by contract against the entry of judgment it is not necessary for him to pay or satisfy the judgment before bringing action on the contract of indemnity, as the scope of the contract may be enlarged to include mere liability to loss from entry of judgment as well as actual loss resulting from the payment or other satisfaction of a judgment.

Various forms of insurance, such as fire, liability and fidelity insurance, are based on the principle of legal indemnity.

Unlike contracts of guaranty or suretyship, which are collateral undertakings, agreements to indemnify are original contracts. In some states this distinction assumes importance by reason of the provision contained in the Statute of Frauds to the effect that an enforceable promise to answer for the debt, default or miscarriage of another must be in writing. According to the decisions in these states, a contract of indemnity, being an original undertaking and not one to answer for the debt or default of another does not come within the Statute of Frauds. Cases in other jurisdictions, however, are in direct conflict with this view. C. F. We.

INDEPENDENCE, a state of freedom. Politically the term implies the Autonomy of the country said to be independent. The American colonies became independent in their own eyes when they formulated the Declaration of 1776. The first nation to recognize their changed status was France, which did so by treaty in 1778. England conceded this status in the terms of the treaty of peace of 1783. Under the British Empire at present a colony with dominion status (*see* Dominions) may be independent as far as all practical decisions are concerned, but yield a voluntary and nominal obedience to the head of the Empire.

INDEPENDENCE, a city in southeastern Kansas, county seat of Montgomery Co., situated on the Verdigris River, 20 miles northwest of Coffeyville. Bus lines, an interurban line and two railroads serve the city. There is an airport. Independence is surrounded by the rich mid-continental oil and gas fields of the United States and is a shipping center for oil and grain. The local industries include the manufacture of oil field equipment, revolving doors, cement brick and glass. In 1929 the factory output reached an approximate total of $1,000,000; the retail trade in 1929 amounted to $8,458,601. Independence was founded in 1869 and incorporated in 1872. Pop. 1920, 11,920; 1930, 12,782.

INDEPENDENCE, a city in northwestern Missouri, the county seat of Jackson Co., situated near the Missouri River, 10 mi. east of Kansas City. Bus lines and three railroads afford transportation. Grain and fruit are raised in the vicinity. The city has a large flour mill, and close by are an oil refinery and a cement plant. In 1929 the manufactures reached an approximate total of $9,000,000; the retail trade amounted to $8,652,204. The largest sales were in the automobile trade. There are valuable mineral springs near by. Independence was plotted and made the county seat in 1827. Joseph Smith came here in 1831 to establish the New Jerusalem, a Mormon city. But he and many of his followers were driven out in 1833. Later those who had remained at Independence founded the Reorganized Church of Jesus Christ of Latter Day Saints and built a very large place of worship. In 1907 a band of Mormons arrived from Utah. In the early days pioneers going farther west over the Santa Fe, the Old Salt Lake and the Oregon trails, started from Independence. An interesting landmark is the old log courthouse, erected in 1827. Independence was chartered in 1849. Pop. 1920, 11,686; 1930, 15,296.

INDEPENDENCE HALL, the old State House of Pennsylvania in which the Continental Congress met and the Declaration of Independence was signed. It is located on Chestnut Street between Fifth and Sixth Streets, Philadelphia, and comprises not only the central building (Independence Hall), but also the Wings or Province Halls, connected by two arcades, and Old City Hall and Congress Hall, on the east and west corners. Independence Hall, designed by Andrew Hamilton, was opened in 1736; the other two buildings were not finished until after the Revolution. A wooden cupola containing a clock was added in 1828.

Among the famous historical events that took place in the building were the meeting of the Legislature, beginning in 1736, the meeting of the Continental Congress and making of Washington commander-in-chief of the American Army in 1775, the signing of the Declaration of Independence in 1776 and the Articles of Confederation in 1781. Congress and the Supreme Court met here; Washington was inaugurated for a second term in 1793, and John Adams took the oath of President in 1797. After the federal government was established in Washington, the buildings were used by societies and public officials. Various alterations were made, but later the original plans were restored. Independence Hall was opened as a public museum on July 4, 1876. The Liberty Bell which rang the news of the signing the Declaration of Independence in 1776 is now standing on a pedestal in the main hall. The collections, supervised by the Sons of the American Revolution, contain original furniture, prints, maps, books and manuscripts, currency and weapons. There is also a National Portrait Gallery, with paintings of important public men of early American times.

INDEPENDENT CHURCHES IN THE UNITED STATES, those churches not identified with any ecclesiastical body. The group includes

churches and missions run as private enterprises, or led by individual ministers not affiliated with any denomination; community churches under various names not affiliated with any other organized religious body; united or federated churches with members of specific denominations organized separately for various reasons, and certain churches with a denominational title which are organized independently. They represent a constantly shifting number, due to consolidations and failure to secure support; but a rough estimate would place their total number at about 750, located in every state in the Union, but principally in New York, Illinois, Massachusetts and California. Their total membership is in excess of 75,000, and they own church property valued at about $5,000,000. One-fifth of them hold their meetings in halls and private homes, and approximately one-sixth own parsonages for their ministers. Four-fifths conduct their services in the English language; the principal language of the balance is German. No general statement can be made of their doctrines or polity, as each organization draws up its own creed, if any; makes its own conditions of membership, and conducts its worship as it seems best. The term Independent Churches is not to be confused with the Congregational Churches, which as early as the 17th century began to be called Independent Churches in England.

INDEPENDENT TREASURY. During its earliest years the United States Government kept its money in state chartered banks, or the branches of the BANK OF THE UNITED STATES. During the Jackson administration, the difficulties attending the panic of 1837 forced the establishment of an Independent Treasury in 1840, repealed in 1841, and reestablished in 1846. By this act, government officers were responsible for all the money collected by them. Since public dues were received only in gold or silver coin, and treasury notes, and payments were to be made to the TREASURY DEPARTMENT in the same media, the government became independent of the banks. The necessity of handling large amounts of money soon created problems. Actual shipment of coin was frequently necessary—and expensive. The credit operations of banks required a bank reserve in coin, and the fact that the Treasury alternately hoarded and released large amounts of coin had serious consequences for the money market. These difficulties made it impossible for the Independent Treasury to be administered according to the spirit of the law, although serious efforts were made to conform to its letter. The law was changed under the pressure of Civil War financing, and banks which made loans to the Treasury kept the proceeds on deposit for the account of the government. The revision of the NATIONAL BANK ACT in 1864 made national banks legal depositaries for all government funds except customs receipts, which were later placed in banks. The independence of the Treasury made the Secretary of the Treasury responsible for the condition of the money market; he felt obliged to buy securities, to prepay interest on government bonds and increase or shift deposits whenever there was a stringency. This unfortunate situation lasted until the passage of the FEDERAL RESERVE ACT. B. H. B.

INDETERMINATE EQUATIONS. An indeterminate equation is one in which the number of unknown quantities exceeds the number of equations. For example, if a single equation be given, such as $x + y = 12$, which contains two unknown quantities x and y, the number of solutions is unlimited. In questions pertaining to such equations it is usual to restrict the solution to positive integral values. If we make this restriction for the solution of $x + y = 12$, we have

If $x =$	1	2	3	4	5	6	7	8	9	10	11
Then $y =$	11	10	9	8	7	6	5	4	3	2	1.

In equations of this type where the coefficient of neither x nor y is unity, such as $2x + 3y = 9$, we proceed as follows. If $2x + 3y = 9$, then

$$x = \tfrac{1}{2}(9 - 3y) = 4 - y + \tfrac{1}{2}(1 - y).$$

Since x and y are restricted to positive integral values, then $\frac{1}{2}(1 - y)$ must be an integer. Let $N = \frac{1}{2}(1 - y)$, then $y = 1 - 2N$. It is easy to verify that the only value of N which will make both x and y positive integers is $N = 0$, in which case $x = 3$ and $y = 1$. The following is a typical problem to which the solution of simple indeterminate equations can be applied. Some men earning $6 per day, and some women earning $5 per day receive altogether $150 for their daily wages. Determine the number of each that may be employed. The equation is evidently $6m + 5w = 150$. Solving this equation by the method indicated above we have the following possibilities:

$m =$	5	10	15	20
$w =$	24	18	12	6

Indeterminate equations of the first degree are called linear indeterminate equations. The case of two linear indeterminate equations with three unknowns can be reduced, by eliminating one of the unknown quantities, to the case discussed above. In fact, indeterminate linear equations can always be reduced to the final form of $ax + by = c$.

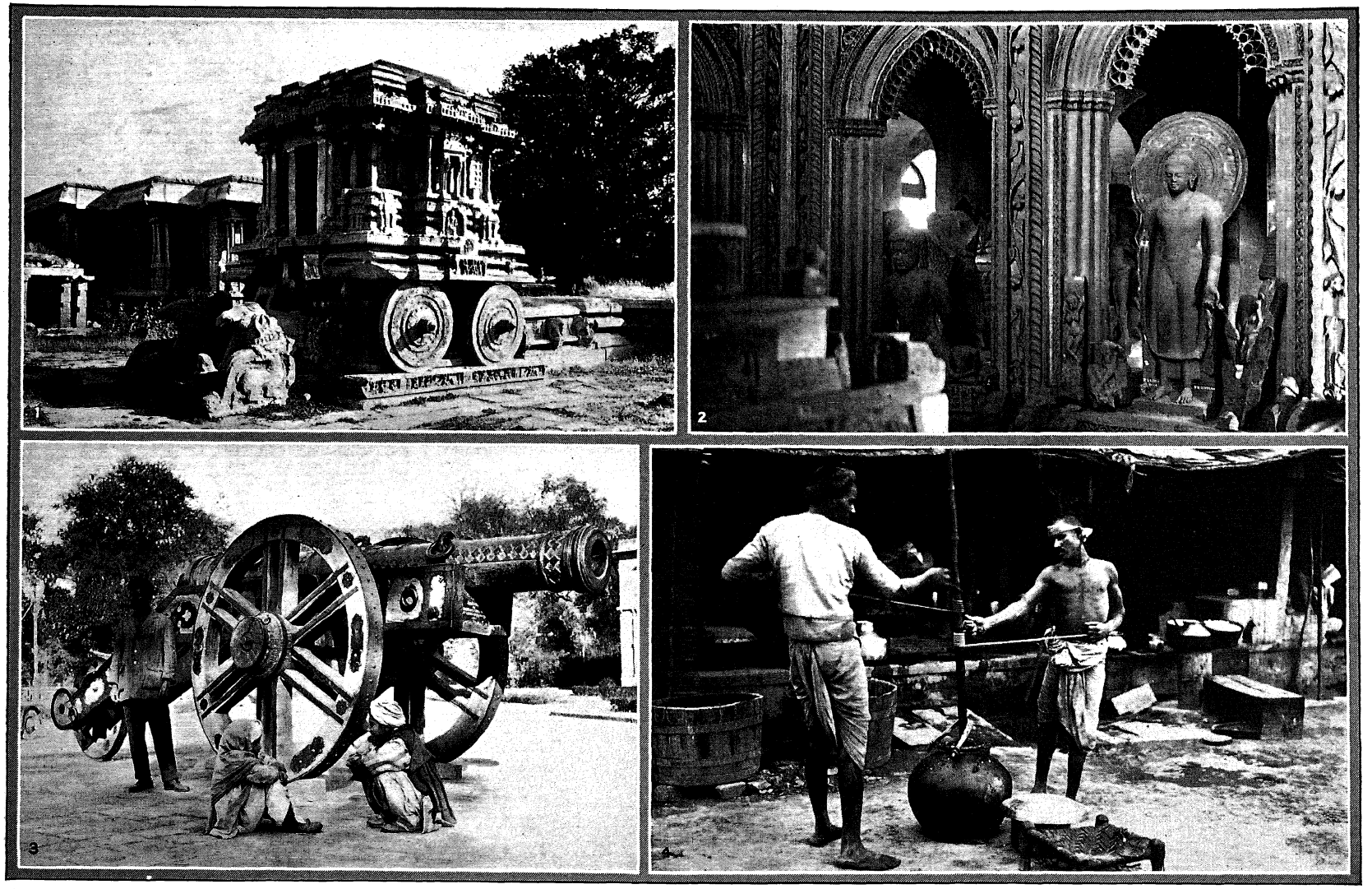
A consideration of such equations of higher order is of fundamental importance in some of the more advanced topics of mathematics, such as the theory of numbers and Diophantine analysis. As an interesting example of such an equation of the second order we may consider the case of $x^2 + y^2 = z^2$, where x, y and z are restricted to positive integers. There is an infinite triad of numbers as restricted above satisfying the equation, such as $x = 3$, $y = 4$, $z = 5$; $x = 5$, $y = 12$, $z = 13$. In fact, for any values of u and v, such that $\sqrt{2uv}$ is rational and integral, the values $x = u + \sqrt{2uv}$, $y = v + \sqrt{2uv}$, $z = u + v + \sqrt{2uv}$ will be solutions of $x^2 + y^2 = z^2$. Such numbers are often called Pythagorean numbers, because



COURTESY AMERICAN MUSEUM OF NATURAL HISTORY

PAINTINGS BY STOWITTS OF INDIAN LIFE

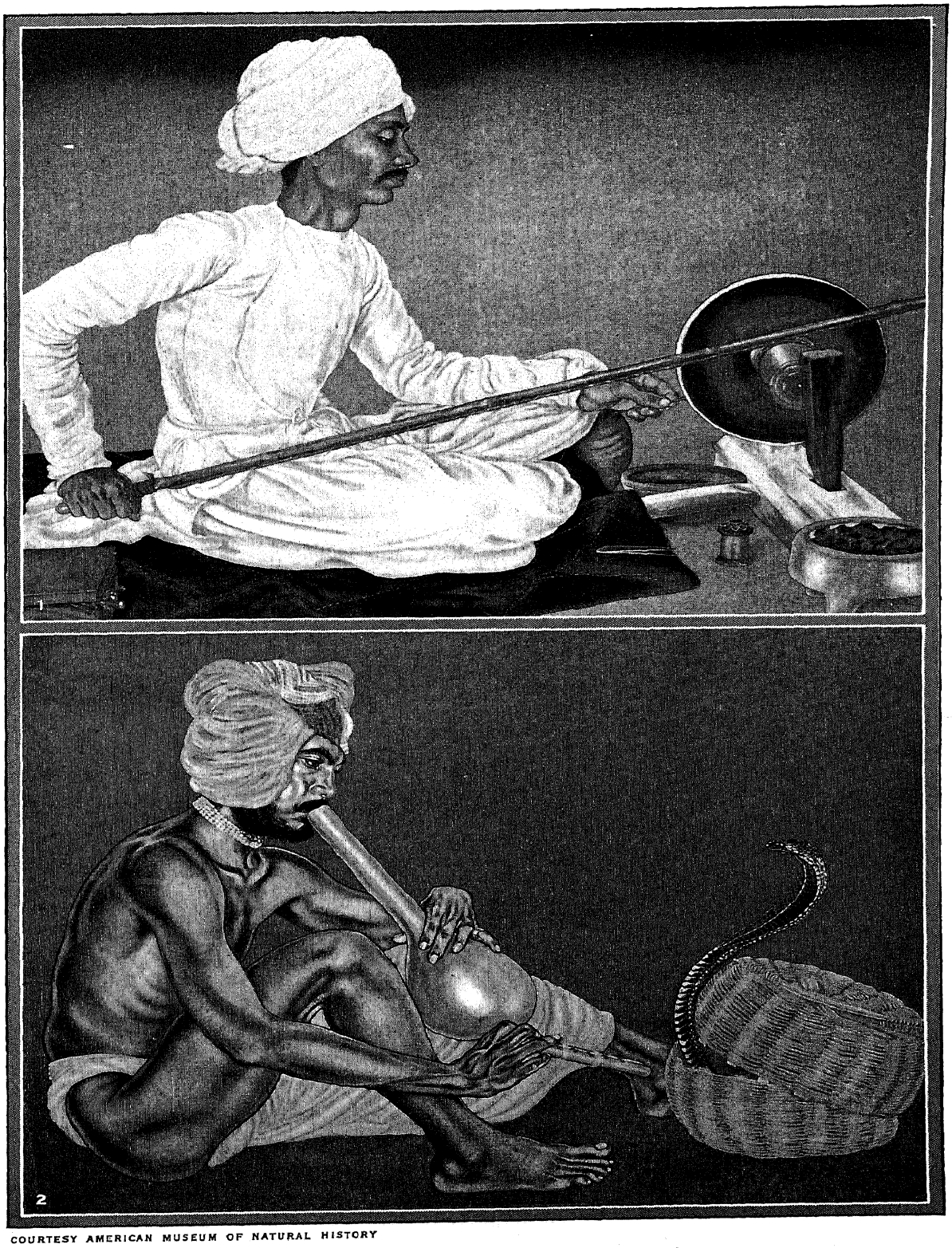
1. His Highness the Maharana of Udaipur who traces his ancestry 140 generations before Agamemnon. **2.** Sculptor of Rajputana carving a Ganesha. **3.** Cobbler's family embroidering Jaipur Rajputana shoes. **4.** Metzakali street drama, a form of the Kathakali, the Malabar national drama; only two companies of this entertainment survive.



COURTESY INDIA STATE RAILWAYS

SURVIVALS OF THE PAST IN INDIA

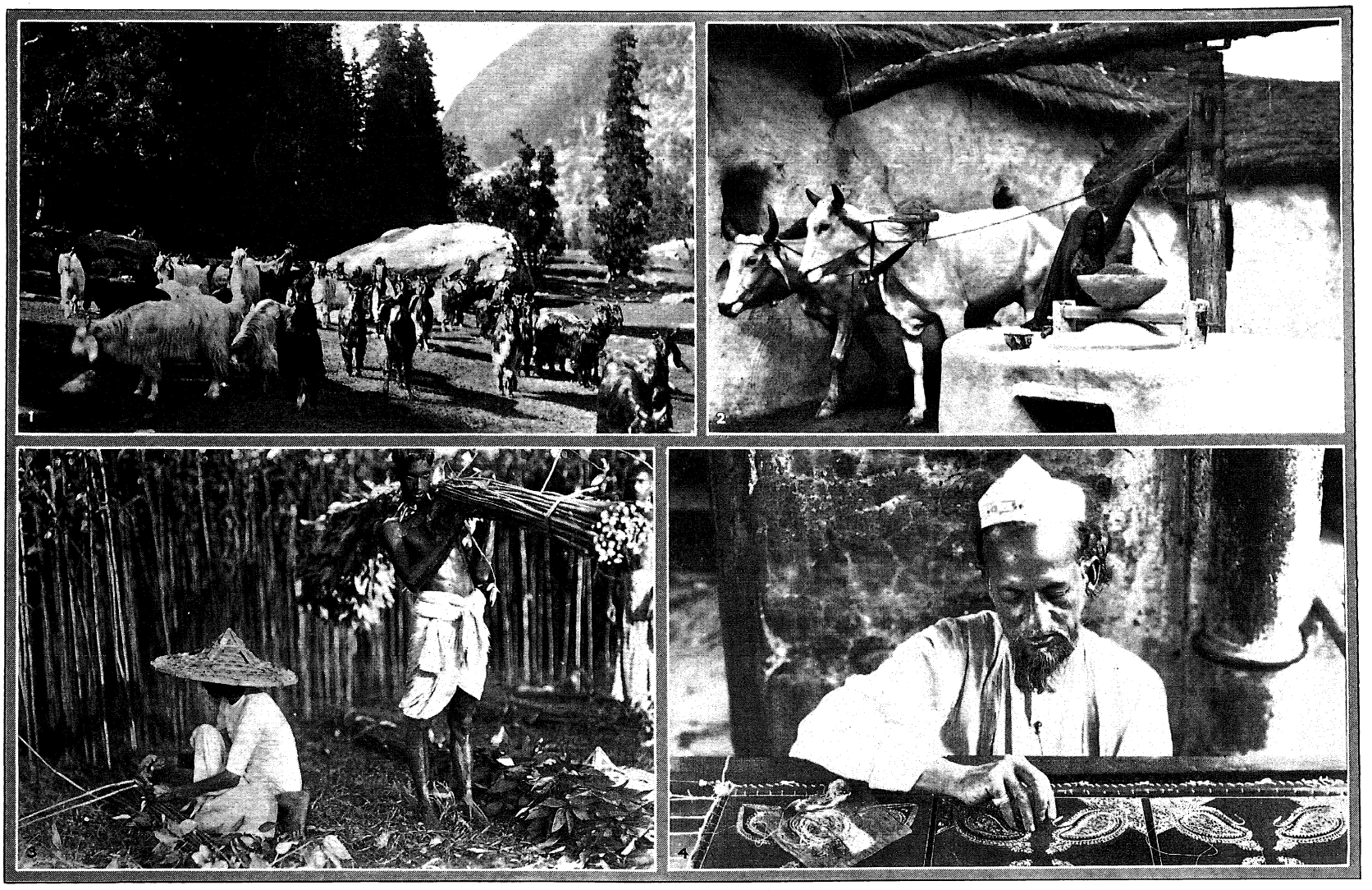
1. Stone car, Vittalaraya Temple, ruins of Hampi, Bellary District. **2.** Archeological Museum, Muttra, showing standing Buddha. **3.** Famous Zamzama gun in Lahore, cast in 1762. **4.** Churning butter by hand with rotating paddle pulled by strings.



COURTESY AMERICAN MUSEUM OF NATURAL HISTORY

INDIAN STREET SCENES BY STOWITTS

1. Precious stone cutter using an emery wheel. 2. The Indian snake charmer is usually a gypsy and invariably a Hindu; he usually wears a turban and orange-colored clothing.



COURTESY INDIA STATE RAILWAYS

PRIMITIVE PRODUCTION METHODS IN INDIA

1. Pashmina goats in the Liddar Valley, Kashmir, the hair of which is used to weave Kashmir shawls. **2.** Stone mill for grinding wheat. Motive power is furnished by bullocks. **3.** Harvesting jute. **4.** A gold embroidery worker, Delhi.

RAND McNALLY POPULAR MAP OF INDIA

SCALE 1:11,341,000

1 Inch = 179 Statute Miles
1 Centimeter = 113 Kilometers

Statute Miles 100 50 0 100 200
Kilometers 100 50 0 100 200 300

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BURMA
SCALE 1:17,107,000
1 Inch = 270 Statute Miles
1 Centimeter = 171 Kilometers
Statute Miles
Kilometers 100 20 0 100 200 300

INDIA

Ar. 1,802,629 sq. m.
Pop. . . . 351,500,000

PRINCIPAL CITIES
(Including Figures from Latest Population Estimates)

Pop.—Thousands
186 Agra . . . . F 11
274 Ahmadabad . . . H 6
114 Ajmer . . . . F 8
157 Allahabad . . . G 15
160 Amritsar . . . C 8
237 Bangalore . . . N 11
129 Bareilly . . . E 13
95 Baroda . . . H 6
198 Benares . . . G 16
1176 Bombay . . . K 6
1132 Calcutta . . . I 21
82 Calicut . . . O 9
216 Cawnpore . . . F 13
119 Dacca . . . H 23
304 Delhi . . . E 10
80 Gwalior . . . G 11
158 Howrah . . . I 21
82 Hyderabad . . . G 1
404 Hyderabad . . . L 11
93 Indore . . . I 9
120 Jaipur . . . F 9
109 Jubbulpore . . . I 13
217 Karachi . . . G 1
282 Lahore . . . C 8
241 Lucknow . . . F 14
527 Madras . . . P 11
139 Madura . . . P 11
149 Mandalay . . . N 22
346 Manipur . . . N 20
328 Meerut . . . E 11
83 Moradabad . . . E 2
85 Multan . . . D 5
84 Mysore . . . O 10
145 Nagpur . . . I 12
120 Patna . . . G 18
215 Poona . . . K 7
342 Rangoon . . . P 22
101 Rawal Pindi . . . B 6
84 Secunderabad . . . L 11
120 Sholapur . . . L 9
142 Srinagar . . . B 8
117 Surat . . . I 6
120 Trichinopoly . . . P 12

FRENCH INDIA

Area . . . 196 sq. m.
Pop. . . . 290,460

PRINCIPAL CITIES
(Including Figures from Latest Population Estimates)

Pop.—Thousands
26 Chandernagore . . . H 21
47 Pondichéry . . . O 13

PORTUGUESE INDIA

Area . . . 1,638 sq. m.
Pop. . . . 578,572

PRINCIPAL CITIES
(Including Figures from Latest Population Estimates)

Pop.—Thousands
13 Diu . . . . . J 4

CEYLON

Area . 25,332 sq. m.
Pop. . . . 3,306,871

PRINCIPAL CITIES
(Including Figures from Latest Population Estimates)

Pop.—Thousands
284 Colombo . R 13
46 Jaffna . . . . . P 13

BHUTAN

Area . 18,000 sq. m.
Pop. 300,000

NEPAL

Area . 54,000 sq. m.
Pop. . . . 5,600,000

the equation $x^2 + y^2 = z^2$ is the algebraic statement of the Pythagorean theorem in geometry. There is a famous theorem, known as Fermat's Theorem (*c.* 1665), which states that the equation $x^n + y^n = z^n$ where x, y, and z are integers, is impossible when n is greater than 2. G. W. M.

BIBLIOGRAPHY.—For a simple treatment of the subject, consult G. Chrystal, *Algebra,* 1886; Hall and Knight, *Algebra,* 1927.

INDETERMINATE SENTENCE. *See* PRISONS.

INDEX FOSSIL, the remains of a plant or animal species which, in past geological ages, had a fairly wide distribution geographically, but lasted for a relatively short time. The FOSSILS of such a species become characteristic of the SEDIMENTARY ROCKS formed at that time, and are not found in other beds. This is of great importance to the stratigrapher, since by the aid of index fossils he can identify and correlate strata in different parts of the country and, in some cases, in different parts of the world. Fossils which have the widest geographic distribution, together with a restricted time duration, make the best index fossils. Organisms distributed by flotation serve this purpose well, certain types of ammonites, for example, being typical of Jurassic and Comanchean periods. The surface-floating graptolites, confined practically to the Ordovician and Silurian, are index fossils for strata of these periods. *See also* GEOLOGY; MESOZOIC ERA; PALEOZOIC ERA; STRATIGRAPHY.

INDEX NUMBERS, relative numbers computed with reference to an assumed base taken as a standard of comparison and usually represented by 100. As statistical measurements, index numbers focus attention upon relative changes by eliminating cumbersome units in which quantities are often originally expressed; moreover, they can concisely represent average changes in many quantities.

The principal uses of index numbers are to establish comparisons or to measure the average movement of the general price level, wholesale prices in primary markets, prices received and paid by farmers, retail prices, cost of living, industrial production, business activity, security prices, employment, payrolls, wage rates and average earnings. An index of wages divided by an index of the cost of living of wage-earners becomes an index of the purchasing power of wages or real wages. Index numbers of prices are frequently used as divisors in order to convert values in current or actual dollars into dollars of constant purchasing power usually termed 1913 dollars, 1923 dollars, and the like.

Index numbers are usually designed to establish comparisons at various times or in various places. Sometimes the basis of comparison is so chosen that index numbers perform the double rôle of establishing comparisons in both time and place. The standard of comparison, termed the base, may be a single month, a yearly average, or an average of several years; in place comparisons the base is a specified locality; in index numbers of business activity the base may be an estimated normal computed by taking into consideration the factors of year-to-year growth and the season of the year. The base is usually expressed in a form such as July, 1914=100, 1923=100, 1923-25 average =100, Philadelphia=100, computed normal=100.

The simplest kind of index number is obtained by expressing each item in a series of comparable measurements as a percentage of one of them chosen as the base. Most index numbers in current use are composites of simple indexes, combined in an average, usually weighted according to the relative importance of the component series. The kind of average and the method of weighting are generally determined by the purpose for which the index is constructed. E. T. F.

BIBLIOGRAPHY.—Harry Jerome, *Statistical Method;* Irving Fisher, *The Making of Index Numbers.*

INDEX SYSTEM, an arrangement of reference titles in a definite sequence, used for locating material on a particular subject. The titles are generally placed in alphabetical order under classes but they are occasionally arranged phonetically so that names sounding alike are arranged together regardless of spelling. In ordinary card indexing the cards are one directly behind another. In visible indexing the cards are mounted in such a manner that they overlap making their title lines visible.

INDIA, the large peninsula jutting southward from central Asia, together with a region lying to the north and east of this peninsula which, with the peninsula itself, forms the British Indian empire. This area was not brought under a more or less unified rule until the 19th century and only then did the term "India" come into use for the whole region. Prior to that time, although the land had been inhabited long before written history, it had been divided up in various ways between rulers who controlled areas, the boundaries of which expanded and contracted with the fortunes of war.

As the empire now stands, its ocean boundaries are formed by the Bay of Bengal and the Arabian Sea. The land boundaries, starting with Persia on the west, pass Afghanistan, the Chinese province of Sinkiang, the Chinese dependency of Tibet, the independent kingdoms of Napal and Bhutan, the Chinese provinces of Hsikang and Yunnan, the French possession of Indo-China and the independent kingdom of Siam. The longest dimension from east to west is approximately 2,650 mi.; that from north to south is approximately 2,000 mi. The empire's area is about two-thirds and its population approximately two and one-half times that of the continental United States.

The island of Ceylon, just south of the tip of the Indian peninsula, is administratively separate from India, though under British rule. The ANDAMAN and the NICOBAR islands in the Bay of Bengal are administered under the supervision of the Indian empire. The French still have five small settlements on the coast of the peninsula, with a total area of 203 sq. mi. The Portuguese have three settlements on

the peninsula, the largest being that of GOA; the area of the three settlements totals 2,365 sq. mi.

The British Indian Empire contains 15 provinces directly administered by the British; these, taken together, being known as British India. Scattered among the provinces are what are called "native states," some 700 in number, which are under the authority of princes or chiefs who are independent in varying degrees. The largest of these native states are KASHMIR in the far northwest, the RAJPUTANA agency in the river plains region and HYDERABAD in the peninsula. Some of the smallest states include only a few villages. Along the northern frontier of India are a number of states whose political status in relation to the empire is in flux.

Physical Features. India is divided into four principal sections: the peninsula, the river plains region, the Himalaya Mountain regions and BURMA. The peninsula to the south, sometimes called the DECCAN, is roughly in the form of a triangle, with its base to the north approximately at the Tropic of Cancer and its apex some 8 degrees north of the equator. The peninsula is a table-land, sloping somewhat from west to east and bounded on all three sides by mountains, the Vindhya range to the north and the East and West Ghats on the other two sides. The rivers of the peninsula drain off eastward.

The river plains region, sometimes called Hindustan, lying between the table-land of the peninsula and the Himalaya foothills, stretches from the Afghanistan frontiers and the Arabian Sea on the west to beyond the northern end of the Bay of Bengal on the east. This is the most densely populated and agriculturally the most productive part of the empire. Three distinct river systems flow through this plains area: 1. That of the BRAHMAPUTRA which rises far back in the Himalayas and, flowing south and west, finds its way down to the Bay of Bengal; 2. That of the GANGES which drains the southern slopes of the Himalayas and flows eastward to the Bay of Bengal where its mouth and that of the Brahmaputra unite to form a vast delta; 3. That of the INDUS, which rises in the remoter mountains, flows southward and empties into the Arabian Sea. This river plains area is the region into which the successive invaders from the north have pushed, after finding their way down the passes through the Himalayas.

The Himalaya mountain country forms the third and northernmost part of India. These stupendous mountains lie like a crescent 1,500 mi. long with the outer curve southward. Offshoots at each end, supplementing the main ranges, serve both to protect India from invasion and to cut it off from its neighbors. The southern slopes of the Himalayas come down to the river plains.

The fourth principal section of India includes what formerly was the kingdom of Burma, lying to the east of the Brahmaputra River region. Burma has a river system of its own, that of the Iriwaddy, which flows southward to empty into the Bay of Bengal near its eastern shores. This river runs through a wide plain, which rises to mountains on either side and on the north. The plain is fertile and well watered; the mountains are heavily forested.

Climate. India stretches from close to the equator to well into the Temperate Zone. The northern parts, rising into the Himalayas, reach elevations which give them definitely a temperate mountainous climate. The river plains region and Burma lie on the borders of the tropics. As the vast plains in the Deccan and Hindustan begin to warm up with the approach of summer, the rising air causes the "warm" monsoons to blow in from the sea. These come heavily laden with moisture, some of which is deposited on the Deccan while most is carried northward to the slopes of the Himalayas. This gives an exceptionally heavy rainfall in the river plains region, and particularly on the mountain sides themselves, during the rainy season of early summer. The "dry" monsoon, blowing during the late autumn and early winter, comes off the land regions to the northeast, and brings relatively very little moisture. Behind mountain ranges which check the moisture-laden winds lie regions which are more or less arid and form the desert areas. The principal arid sections are in the valley of the Indus and along the eastern side of the Deccan table-land.

Flora. The plant life of India varies very widely in kind and size, according to location. In the well-watered and more southern regions, typical tropical jungles develop; along the deltas of the great rivers the banyan trees and undergrowth make a dense and frequently impenetrable mass. Palms grow along the coast, and birches and evergreens in the mountain areas to the north. The bamboo is widespread. Orchids are found in very great variety. Rice and millet are the principal food grain crops; barley, oats, beans and various other foods are grown, as are vegetables, cotton, jute, spices, sugar and tea.

Fauna. The tiger is the most widely-distributed of the beasts of prey of India, although the leopard and the cheetah also abound and a few lions live in the Kathiawar region. Panthers, bears, lynxes and wolves are found in the northern Himalayan areas. The elephant is found in many parts of India, though not in the northwest. Rhinoceroses, goats, sheep, bison, antelopes and deer of several kinds are found wild in various parts of the country. There are parrots of many kinds and of great beauty. The vulture, the eagle and the falcon are the principal birds of prey. Water fowl are numerous. Snakes abound; the majority being comparatively harmless but some being extremely dangerous because of the quickness with which their poison kills. Of these latter, the cobra is the most dreaded. Fish abound in all the waters of India, the carp and catfish families being the best represented. The ox is the most important domestic animal, with the buffalo next. Sheep, goats, horses, mules, donkeys and chickens of various kinds are widely raised.

Agriculture. Farming is the principal industry of India, and that by which approximately three-

fourths of the people are supported. Agricultural crops and methods vary to suit local conditions, but throughout most of the country, except on the barren mountain slopes and the desert or semi-desert areas, the life of the people is organized around the occupation of getting food from the soil. The principles of crop rotation and of the use of manure are widely understood, but poverty not infrequently prevents their full application. Irrigation is carried out wherever possible. In recent years the British government of India has put large sums into developing irrigation projects; wells and streams are drawn on elsewhere by the people. The cultivated area, in no small part because of the development of irrigation systems, has been increasing steadily until in recent years it has reached in British India over 226,000,000 acres, with another 50,000,000 acres lying fallow each year. The cultivated area is approximately 40% of the total area. The total irrigated area is some 47,780,000 acres, of which 28,100,000 are supplied with water from government works.

Large sections of India periodically fail to receive adequate rainfall, so that famines occur. The Ganges delta area and the provinces of Assam and Burma are practically never drought-stricken. The Indus valley, the eastern part of the Deccan and the upper Ganges regions have suffered especially from droughts. Failure of rain for one year brings great suffering; drought continuing over two or three years causes disaster. The worst famine for centuries occurred in 1876-78, which affected practically the whole of India but especially the Deccan.

The principal agricultural crops and their relative importance were, in 1928: Rice, 27,972,000 tons; wheat, 7,762,000 tons; sugar cane, 3,221,000 tons; rape, mustard, sessamum seed and linseed, 1,741,000 tons; cotton, 5,871,000 bales; jute, 10,180,000 bales; tea, 390,920,000 pounds; rubber, 26,042,800 pounds. India is exceeded only by the United States in cotton production.

Minerals. India is well supplied with mineral resources, and substantial amounts of coal, iron, manganese, tungsten, copper, lead, gold and silver are being produced. The 1927 production of coal was 22,082,000 tons; of iron ore and manganese ore, over 1,000,000 tons each, and of lead 451,000 tons. In 1929 India produced 8,366,000 barrels of petroleum.

Industry. Manufacturing in India, in spite of the rapid development in recent years of factories in some of the principal cities, is carried on chiefly by craftsmen in the small rural hamlets as it has been since time immemorial. The more specialized occupations, such as the making of pottery, brassware and iron articles, are passed on from generation to generation in the same family. Weaving of cotton cloth on hand looms is carried on very generally. The making of cotton cloth in India dates from very early times, and cotton spinning and weaving still are easily the most important non-agricultural industries. Something over 2,000,000 hand looms are in use, and over 30% of the 1,500,000 factory workers are employed in cotton mills, gins and presses. Since the World War, cotton cloth production in India has increased considerably. The development of cotton mills in China has seriously cut into the market in that country for Indian-made cotton goods. Jute manufacturing (gunny bags, etc.) comes second as a factory industry, about 350,000 being employed in this work, and the Indian mills making about twice as much jute products as all the rest of the world. The tea and the silk-weaving industries together furnish employment to a million or more people.

Other important factory industries are rice cleaning, machinery manufacturing and founding, sugar manufacturing and printing. Woolen goods, chiefly carpets and shawls, and gold, silver and brass articles and jewelry are manufactured widely, but chiefly by handicraftsmen or in small plants.

The Nationalist movement, led by GANDHI, has sought to revive the use of the spinning wheel and the hand loom in the homes and has affected both the imports and the manufacture in Indian mills of cotton yarns and cloth. In 1927 British India, exclusive of the native states, had 6,393 factories in addition to those owned by the government.

Communications. Roads, rivers and canals formed the principal channels of communication and transport in the earlier days in India, but the railways, since their construction in the middle of the 19th century, have steadily increased in importance until today they predominate. The first railway line was opened in 1853, running a short distance from Bombay. In 1928 there were 52,886 mi. of railways in operation in India, 40,299 being British India government lines, 4,988 belonging to the native state lines and the rest being private lines. Four different gauges are used in the railways, making exchange of equipment between the different systems impossible.

India has over 200,000 mi. of roads, the principal highways being metalled and kept in good condition. The only navigable rivers in India are the Indus, the Ganges, the Brahmaputra and the Iriwaddy. Before the coming of the railways, these rivers formed the principal channels through which goods moved from the interior to the coast; even yet, during the high-water periods, they carry large fleets of boats loaded with produce. The total navigable length of the rivers is approximately 4,000 mi. Most of the larger irrigation canals are so constructed as to be available for navigation by small boats. Postal telegraph and telephone communications have been established throughout the empire, and radio communication is being developed. Regular passenger and mail air services are maintained to and from Europe.

Foreign Trade. India is located on the ancient trade routes between the Mediterranean basin and the Far East, and by both sea and land it has had for many centuries an important foreign trade. After the British EAST INDIA COMPANY secured predominance in the country, in the 18th century, the foreign trade came to be chiefly with Great Britain and subsequently with other parts of the British Empire.

Since the World War trade has become geographically more diversified. For the years 1911-13, 64% of the imports came from Great Britain, while Britain took on the average 29% of the exports. In 1928, imports from Britain were only 39% and exports to Britain 25% of the totals. Trade with the United States has shown a steady growth in recent years. In 1929 imports from the United States were $55,360,000, or 5% of the total, and exports to the United States were $149,300,000, or 12%. Raw and virtually unmanufactured products form the bulk of Indian exports, with manufactured goods next. In recent years, imports, particularly of cotton goods, have fallen off; imports of steel and iron have remained stationary; machinery imports have increased greatly. Gold and silver form an important part of the imports. The sea-borne trade of India in 1929 was: imports, $1,063,500,000; exports, $1,247,000,000; total $2,310,500,000. The land frontier trade totalled approximately $12,250,000. Indian foreign trade in recent years regularly has shown an excess of exports from 15% to 18%.

Finance. From very ancient times the principal source of governmental revenue in India has been the land tax, sometimes referred to as the "rent" which occupiers of the land pay to the government, the theoretical owner of all the land. This remains true today for the native states; but in British India, since the changes in the system of taxation and the increase in customs receipts, tax returns and customs duties are the principal revenues. The second income source was and is a tax on the income of persons not occupying land. The methods of assessment and collection of both these taxes have varied considerably through the centuries, and the British have changed their system from time to time. On the whole, the taxes under British administration have been and are considerably less burdensome than they were, for example, under the Mogul emperors. In 1928-29 the budget provided $217,500,000 or 60% of the total expenditures for defence, and $44,000,000 or 12% for the civil administration; $187,500,000 or 52% was expected from customs charges, $64,000,000 or 18% from income tax and $26,000,000 or 7% from salt taxes. The budget balances at receipts and expenditures of $362,000,000.

The *rupee* is the basic coin in India. Until April 1, 1927, the currency had been on a silver basis. On that date a gold standard was adopted, with a rate of 13.33 rupees to the British gold pound or one shilling and six pence to the rupee, or the equivalent in American currency of 2.75 rupees to the dollar, or 36.5 cents to the rupee. The Imperial Bank of India was established in 1920 by combining the three principal "presidency" banks; this bank acts for the government. The principal Far Eastern foreign exchange banks operate in India. In most cases the many native banks are little more than money lenders. The public debt of British India on March 31, 1928, was $3,625,000,000, about two-thirds being for productive purposes. Expenses for irrigation, road improvements, etc. are borne by the provincial governments.

The Nationalist agitation in recent years on the financial side has been directed against British control of governmental finances. Under the present system the governor-general has the authority to certify and thus legalize appropriations over the heads of the legislature. The Nationalist campaign for non-cooperation, through refusal to pay the land tax, is in part an attempt to assert the principle that the land belongs to the people, as against the centuries-old doctrine that it belongs to the government.

Defence. Britain, first the British East India Company and then the British government as such, established her authority in British India by force; and the defence of the realm against outside attack, particularly against attack from the north, has played an important part in all British plans concerning India. The total strength of the army in India varies somewhat from year to year but is around 205,000. At present about two-thirds of the troops are Indian and one-third British. In recent years the policy has been adopted of opening the way to command by Indians; previously the commissioned officers all were British. The commander-in-chief of the army sits as the "army member" of the governor-general's council. There is no system of general conscription or compulsory military training in British India.

Government. Through the centuries India, in its several divisions, had its own rulers, some of whom came in as invaders. The governments were despotic in form and, generally, in practice. Local affairs were taken care of in the main by the rural communities themselves. The Mogul empire was in control when the British and French started operations in India in the 17th century. By a series of wars and diplomatic moves the British secured control of the areas which now form the provinces of British India and suzerainty over the present native states. Up to 1858, the British East India Company had been the dominant factor in the development and administration of British interests in India. In that year, control was taken over by the British government and British parliamentary legislation provided that all India should be governed by the king, or queen, of England, acting as emperor, or empress, of India, through a secretary of state for India. The head of the administration in India itself was given the title of viceroy. The viceroy serves also as governor-general of the British provinces. The rulers of the native states give feudatory submission to the British crown, and are under varying degrees of control by the viceroy. The governor-general, acting with and through his council, and subject to the British secretary of state for India, who is a member of the British cabinet, and to the British parliament, formerly had completely autocratic powers in India. In 1882, the then governor-general issued orders providing for local and municipal committees, the members of which were to be elected. Steps also were taken to bring Indians into the government councils.

In 1909 the Morley-Minto reforms were introduced, providing for further extension of the electoral principle and giving the partially elected legislatures greater influence. The legislatures still were, however, advisory bodies, with no control over the executive officers, provincial or imperial, who remained responsible to the government at London. The Montagu-Chelmsford constitution of 1919, passed by the British parliament, provided for the gradual introduction of responsible parliamentary government, clearly separated the authority of the central government from that of the provinces and placed part of the functions of the government in the principal provinces under the authority of a council of ministers, responsible to the provincial legislature. The 1919 legislation also provided for a central legislature of two houses, a majority of the members of which are elected. The governor-general and his executive council remained responsible solely to the British parliament. The governor-general may stop the consideration by the legislature of any bill which he thinks would "affect the sofety or tranquillity of British India or any part thereof." He may veto any bill or refer it to London. He may recommend bills to the legislature and make them into acts on his own responsibility whether approved by only one or by neither of the chambers. In such cases he must certify that the measure is necessary, the act must be laid before both houses of the British parliament and it cannot come into force, except in emergencies, until approved by the British king. The central legislature votes the budgets and supply appropriations but the governor-general may put through an appropriation which he considers essential even if it be refused or reduced by the legislature. Under this authority, the governor-general recently has enacted several of the budgets without the consent of the legislature.

The 1919 program specified that the question of further changes toward greater self-government in India should be taken up in ten years. In the interval, the Nationalist agitation in India grew, but the Nationalists have failed to respond to requests that they prepare and submit a constitution, on which the Indians themselves could agree. In 1927 the British parliament decided to sent a commission to India to study the situation. This commission, headed by Sir John Simon, went out in 1928. It presented its report in 1930. In 1931 a round table conference was held in London, attended by British delegates and Indian representatives of the Nationalist groups and of the native states. No definite new constitution was agreed upon, but plans were made for further study of the problem. Nationalist agitation against the British was renewed at the end of 1931 immediately after the return of the Indian delegates to India.

The secretary of state for India has a council which may vary from eight to twelve members, and usually includes some Indians. The governor-general has his "cabinet" or executive council, with and through which he acts in administrative affairs. The governor-general is appointed by the British crown, usually for 5 years, as are the members of his council. The governors of the nine principal provinces are appointed by the crown, the others by the governor-general. Elections to the legislative bodies, central and provincial, are direct and mainly by geographical districts. The franchise is based on property qualifications which vary somewhat in the provinces. Women have a partial franchise in some provinces. There are more than 5,000,000 voters. The capital is at DELHI; the summer capital at SIMLA. Within the provinces are the administrative districts of which there are 273 in British India.

Education. Although from very ancient times the privileged few have been taught the arts of reading and writing no serious effort to make educational facilities available for the masses was made until the beginning of the 19th century. In the 1921 census, only 1.8% of the females and 12.2% of the males or 7.2% of the total population were literate in the sense of being able to read and write a letter in their own vernaculars. The British officials and the Christian missionaries began to concern themselves with education in the 18th century, but it was not until 1854 that any comprehensive plan for a state system of education for the whole people was drafted. From that time educational development in India has been chiefly in the hands of the government, and private institutions, such as those of the missionaries and of various Indian organizations, have been required to comply with governmental standards if they wished official recognition. The government carefully kept education secular, but a situation grew up in which education came to be considered chiefly as a stepping stone to official position, with the results that many of the "educated" had only a superficial and mechanical knowledge and that what education the students did have was of no value in commercial life. These difficulties were intensified by the fact that higher education was developed comparatively much more adequately than secondary and primary. A complete reorganization of the entire governmental educational system, particularly of the universities, was initiated as a result of a study of the situation by a special commission which reported in 1919.

While the main burden of developing education in India has been carried by the central and provincial governments, a good deal has been done by private individuals and groups, Indian and western. The Brahmo Samaj organizations, the theosophists, the Nationalists and a number of wealthy Indian individuals have established and maintained schools of various grades, including universities. The Christian missionary agencies have done likewise.

In 1926 there were 290 colleges and universities in India, with an enrollment of 87,589, as compared with 160 such schools having 18,783 students in 1897. The schools of all grades increased from 152,025 with 4,356,870 pupils in 1897 to 237,823 with 10,514,321, or 3.3% of the population, in 1926.

Religion. Religion plays a more vitally penetrating part in the life of the people in India than in

any other civilized country. This is as true to-day as it has been since centuries before the time of Christ. In actuality the caste divisions are partly ethnological and occupational in origin, but religious grounds customarily are assigned for them. Religious observances are considered the primary duty by practically all the people. Religious differences are perhaps the most common cause of clashes between separate groups; they form in many ways the most serious stumbling block to the working out of a practicable form of self-government for India.

HINDUISM is the predominant religion in India, but Hinduism itself is divided into scores of sects, to such an extent that it is almost impossible to give any central doctrines. Hinduism is the oldest religion in India; it has its roots in the beliefs both of the very early Aryan invaders and of the pre-Aryan inhabitants. Over 216,700,000 of the people are classified as Hindus, or 68% of the population. MOHAMMEDANISM, becoming important in the 11th century, ranks next in strength. There are some 68,700,000 Mohammedans to-day, or 22% of the people. BUDDHISM, which had its start 500 years before Christ and attained great influence during the time of ASOKA in the 3rd century B.C., to-day has some 11,600,000 Buddhists in India, of whom by far the larger part are in Burma, which is predominantly Buddhist. Christianity entered India early. There is a tradition of doubtful authenticity that St. Thomas the Apostle preached in southern India and was martyred near Madras in 68 A.D. At any rate, Christian settlements existed as early as about 190 A.D. The Manichaeans and Nestorians were on the ground not long after this. Catholic missionaries came in with the Portuguese in the 15th century. The first Protestant missionaries arrived in 1705. There are some 4,754,000 Christians in India to-day, forming 1.5% of the population, of whom 1,823,000 are Catholics, and 1,893,000 adherents of modern Protestant denominations.

Population and Area. All of India has an area of 1,805,332 sq. mi. with a population, 1921, of 318,942,480; 1931, 352,986,876. Of these 1,094,300 sq. mi., or 61%, and 271,749,312 people, or nearly 77%, are in British India and 711,032 sq. mi. and 81,237,564 people are in the native states. CALCUTTA is the largest city, with a population in 1931 of 1,419,321, including suburbs and Howrah; BOMBAY City and Island comes second with 1,157,851. There are 33 cities with populations over 100,000, and 51 with populations between 30,000 and 100,000; approximately 90% of the population, however, is rural. G. C.

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INDIA, HISTORY OF. India has been inhabited from very ancient times. Traditions and the languages of the present-day descendants of the very early inhabitants indicate that they belonged to three principal racial stocks (Mongoloid, Negroid and Dravidian) and that they all came down into India from the north. Beginning some time well before 3,000 years ago, another invasion from the north took place, the newcomers being of what is called Aryan stock. These Aryan invaders drove the pre-Aryan peoples out of the fertile river plains and back into the forests and down into the south. Descendants of the pre-Aryan peoples still form an important part of the population; particularly the DRAVIDIANS who, in the main, are settled in the south. Roughly speaking, the present-day Hindus are the descendants of the Aryans, though there has been considerable absorption into the Hindu groups of parts of the pre-Aryan races. The non-Aryan peoples who still remain distinct number in the neighborhood of 18,000,000. In addition a large proportion of the nominally Hindu population, particularly of the lower castes, in reality belongs to the pre-Aryan stock.

The invasions of India by alien peoples did not stop with the coming of the pre-historic Aryans. Successive waves of foreign invaders continued to sweep down, principally out of the northwest, into the rich and fertile river valley areas. Scythians, Arabs, Mongol peoples of various kinds, all at one time or another have moved into the country as conquerors, ruled over larger or smaller areas for a time and then been absorbed or crushed by new invaders. Peoples of the modern European nations—Portuguese, Dutch, French, and English, chiefly—found their way by sea to India in the sixteenth century, and early came into conflict with one another and with the Indians. The old story of conquest was repeated, in essentials, during the next three hundred years, with the British coming out as dominant.

One important result of these successive invasions is that India to-day is a confused conglomeration of races, religions, languages, and cultures. Some 222 different dialects are spoken in India. Of these, 25 belong to the Indo-European group and are used by some 233,000,000 (73%) of the people—in the main the people of Aryan stock and those whom they have absorbed. The Hindus, who now include, as a religious group, approximately 217,000,000 (68%) of the people, are divided into some 2,400 separate castes, each sharply separated from the others by tradition, and usually by occupation. The situation is further complicated by the presence in India of the Mohammedans who began to be an influential factor in the thirteenth century. The 68,700,000 Mohammedans (22% of the people) form a group sharply marked off from the Hindus and the pre-Aryans by a vigorously-upheld religious faith as well as by race. The Buddhists are a distinct religious group (3.6%) of the population, as are the Christians (1.5%). Then, on top of this confused mass of racial, cultural, linguistic, economic, and religious diversity, are the British officials, relatively very few in number but at present exercising political and military control.

The Historical Period. Authentic history in the sense of definitely fixed dates begins relatively late. ALEXANDER THE GREAT invaded India in 327 B.C. but earlier than that, dates are somewhat vague. Nevertheless, a highly developed civilization had developed even before the coming of the Aryans in the period from 2,400 to 1,500 B.C. These invaders found great cities, probably Dravidian, already established. Recent excavations show that the people who built these cities had a culture somewhat allied to that of the roughly contemporaneous Sumerians in the Euphrates valley.

It is interesting to note, in passing, that the invasion of India by the Aryans came at approximately the same time as the movement of the first Chinese down into the Yellow River basin and of the immediate ancestors of the Greeks down into the Mediterranean area. These peoples all pushed southward into warmer and more fertile lands out of the forest and steppe country in central and northern Asia and Europe. The Greeks and Aryan invaders of India belonged to the same general racial stock, and there are indications that the earliest Chinese also were of these light-haired, light-skinned peoples.

The period which saw the flowering of Greek civilization also saw a new birth in India and China. SOCRATES, BUDDHA, and CONFUCIUS were approximate contemporaries. The sudden uprush of civilization in the three areas took characteristically different forms, however. The Greeks did their chief thinking in philosophy, science, and politics; the Chinese did theirs in the field of ethics; the Indians in religion. The middle centuries of the first millennium B.C. in India saw a great religious revival, which resulted in the establishment of many new sects out of the raw material of Hinduism. Buddhism and Jainism, still the faiths of many millions, date from this period. Furthermore, the early period of intellectual and spiritual greatness in Greece, China, and India was followed by the establishment of comparatively short-lived militaristic empires. Alexander the Great ruled and conquered from 336 to 323 B.C. Ch'in Shih Huang Ti dominated China from 249 to 210 B.C. Asoka built up his great Indian empire during the years from 264 to 227 B.C. Each man made a contribution characteristic of his race. Alexander spread Greek art and philosophy through Asia Minor and into India. Ch'in Shih Huang Ti established a form of political organization which lasted down into the modern period. Asoka made the religion of Buddhism dominant and opened the way for its spread into the neighboring countries to the east and into China. After the death of each of these men, the empire which they had established crumbled almost immediately.

In India, Alexander's invasion was followed by the establishment of a powerful empire by a man who had been an adventurer in Alexander's camp. This man, Chandragupta Maurya, maintained close relations with the Greek world. His grandson was Asoka, who extended the domains which his grandfather ruled and brought most of central India under his control. The Maurya dynasty came to an end in 184 B.C. Then followed a succession of dynasties, ruling in various parts of the country, many of them established by foreign invaders. The Scythians from central Asia came in about 100 A.D. The Yueh-chi peoples followed and established the Kushan dynasty. These dynasties collapsed in the 3rd century. The Gupta dynasty (320-480) established peace over most of India. During its time, the land prospered, and Hindu art, science, music, and literature flourished. Barbarian Huns swept across India in the 5th and 6th centuries, as they were sweeping across Europe at about the same time. For 500 years after the Hun invasion stopped India was left to herself. Rulers rose and fell; only one man succeeded in establishing and maintaining power over any large area for any long period. This was Harsha who ruled in the north from 606 to 648.

At the end of the 1st millennium A.D., both of the principal regions of India as it then existed were torn by wars between rival chieftains. The Arabs, when they swept in from the west within a century after the death of MOHAMMED found little opposition. One raid followed another. By 1200 Mohammedan armies had secured complete control of the plains of northern India from the Indus to the Ganges delta. A century later, in 1294, a Mohammedan king, Ala-ud-din Khilji established his throne at Delhi and embarked on a series of campaigns to bring all India under his sway. Before he died he had practically accomplished this, establishing Islamic rule in the Deccan as well as in the plains and the mountains to the northwest. His empire broke up after his death.

The Mogul Period. After another hundred years, in 1398, TIMUR (Tamerlane) invaded India. He and his Mongol horsemen found the country disorganized and no ruler strong enough to offer serious resistance. Timur did not stay in India, and after his withdrawal a new series of petty rulers began their quarrels. In 1525 another Mongol chief, Babur, king of Kabul, a descendant of Timur, swept down into India. By the time of his death in 1530 he had laid the foundations for the great Mongol or Mogul empire. Babur's son lost much of his father's conquests during the twenty-six years of his reign, but the whole and more was regained by Babur's grandson Akbar. Born in 1542, he ruled from 1556 to 1605—thus being a contemporary of Queen Elizabeth in England.

Akbar was the real founder of the Mogul dynasty. Although only 14 when he succeeded his father, he embarked at once on a series of military campaigns. Before he was twenty-one, he held undisputed control over more of India than any previous ruler. He continued his campaigns, and before he died in 1605, he was master of practically all of what now is British India, excepting Burma. Akbar's claim to fame, however, rests chiefly on his success as a civil administrator. He brought the various tributary rajahs in

as integral parts of his administrative system and of his army, and established an efficient system of communications and revenue collection.

While busy with his wars and his administration, Akbar still found time to attempt to establish a new religion. At his court were representatives of the various Hindu sects, Mohammedans, Catholics, Buddhists, Parsees and men of other faiths. He gave them all a hearing. Finally he revived the old Indian idea of a new religion which would embody the best of all the others. He himself, as the prophet and chief priest of this new religion, worshipped the sun daily, and accepted the worship which the common people gave to him as to a god.

Akbar died in 1605. His son held the empire together. His grandson, Aurangzeb, finally extended its boundaries to the southern end of the peninsula, but after this man's death in 1707 the empire crumbled. Nadir Shah of Persia invaded Hindustan and sacked Delhi in 1739. Tributary chiefs rose in revolt in the Deccan and elsewhere. The British and French pushed into India. The power of the Mogul throne disappeared, though the shadow remained, passed on from father to son, until the British, in 1858, formally assumed suzerainty over India.

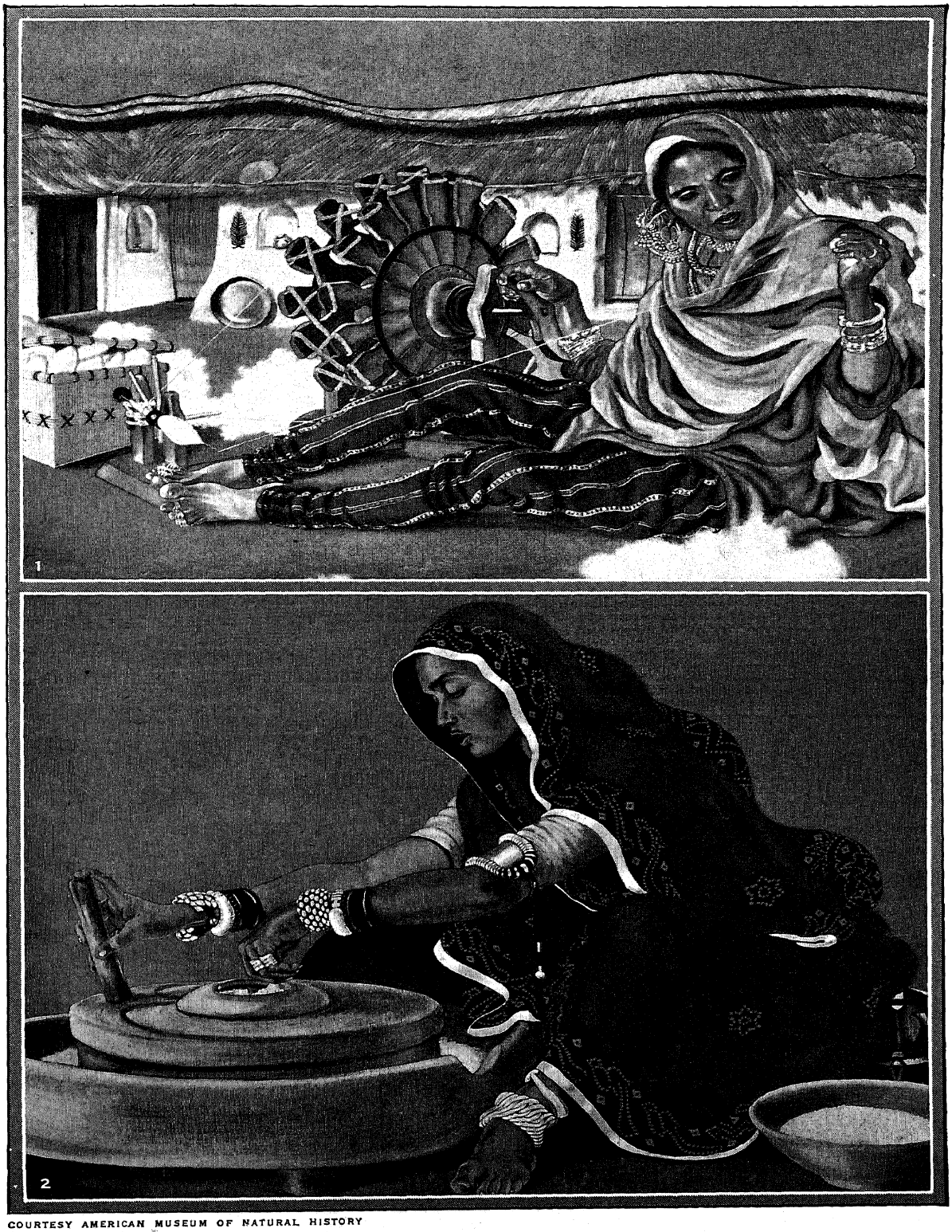
Warriors and conquerors figure prominently in the written histories of India as of other countries, but during the long succession of centuries the mass of the people continued to till the soil, to carry on their handicrafts, to engage in trade with one another and with neighboring countries and, generally, to live their lives comparatively unaffected by the changes in rulers. But one factor in the life of the Indian peoples received an emphasis even greater than in other predominantly agricultural countries. This was the great attention which was given to religion. The old and rigid religious caste lines were maintained, in the main; the old books of the Hindus continued to be revered as sacred; innumerable temples were built; millions year by year went on pilgrimages to the sacred places of the various faiths; religious ascetics by the tens of thousands wandered over the country or sat in hermit retreats, being fed and clothed by the people who thought they acquired merit by giving to these "men of God."

The religious leaders, in fact, have been considerably more influential in the life of India than the military conquerors. These religious men, one after another from long before the time of Buddha, have arisen to enunciate new interpretations of ancient teachings. In the main, these men thought and taught in terms of how man might achieve happiness, or at least release from the pain of life. This was to be accomplished through effective realization of the essential unity of the soul of man with the gods who, themselves, were various manifestations of a single great unity. Akbar, in announcing his new religion, simply was following in the footsteps of many who had gone before. His attempt to combine in that religion the best of all other religions, too, was completely in the tradition which started well before Buddha and has been upheld by successive religious leaders down to men now alive, such as GANDHI. But Akbar did not stress as much as many others had done before and have since the social implications of his religious teachings. The conception of the unity of man and the universe necessarily carries with it the idea of the equality of men. Most of the religious leaders, from Buddha to Gandhi, consequently have fought against the caste system, have insisted on the meaninglessness of distinctions of class and wealth. Most of them, too, have taught that the living conditions of the ordinary man should be improved; many have worked actively to secure such improvement.

This religious factor in Indian life must be borne in mind in order to understand present-day events. The conditions of life of the people have been hard. The people have sought escape through religion. Their emotions and their thinking have been pointed toward a future life, rather than toward dealing with the here-and-now world. They have learned to follow more or less blindly the teachings of a leader who promised that if they would walk in his Way they would achieve ease and peace. They have looked steadily toward the distant goal rather than at the practical difficulties in the road. The divisions into many castes and sects, too, have militated against the development of real capacity to sink differences for the sake of uniting on a common program. And, until relatively very recently, the Indians have neither had, nor known of, nor wanted anything in the nature of self-governing democracy.

The Westerners Arrive. The Portuguese were the first modern Europeans to start trade with India. Vasco da Gama arrived at Calicut in 1498. For the next century the Portuguese enjoyed virtually a monopoly of trade with the Far East; then their influence began to wane and to-day it is negligible. The Dutch came on the scene at the beginning of the 17th century. They established minor footholds in India and at various other points in the East Indies and the Far East. The British ousted them from India in the latter half of the 18th century. The French had started trading with India early in the 17th century, and acquired their first territorial possessions there in 1674 and 1688. For a time they were serious rivals of the British for predominance in the country, and several clashes occurred between French and British forces, acting by themselves or as backers of rival Indian claimants to one throne or another. Finally, in 1761, the British defeated the French and secured a clear field for themselves. The French still have five small areas on the Indian coasts, and the Portuguese have three.

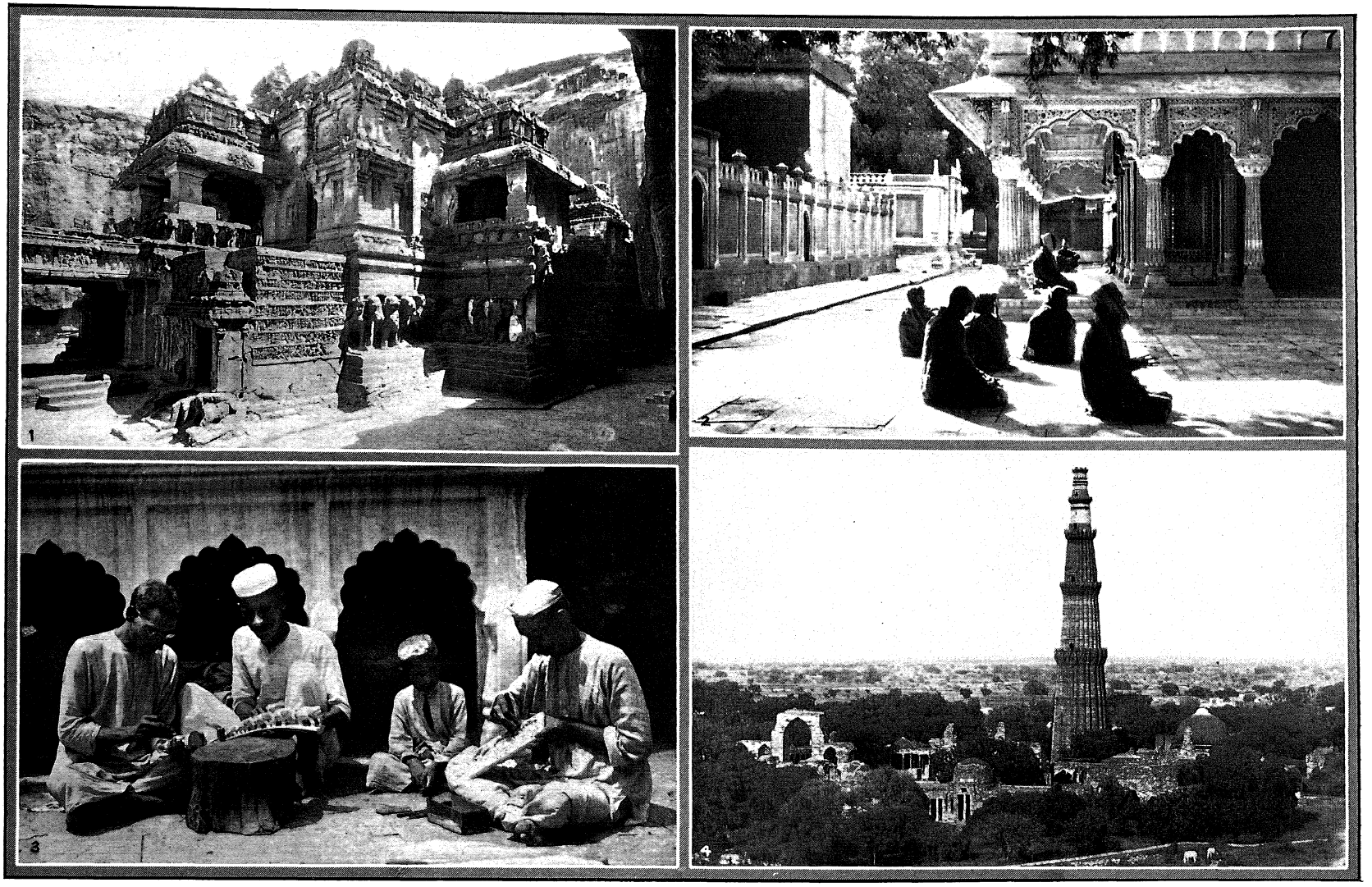
The first British settlement on the mainland of India was made in 1612. From then on, by the expansion of trade interests, by the use of force against rival Europeans and against antagonistic Indian rulers, and by diplomacy and intrigue, the British steadily extended their influence. The definite start toward



COURTESY AMERICAN MUSEUM OF NATURAL HISTORY

INDIA'S PRE-MACHINE AGE WORKERS

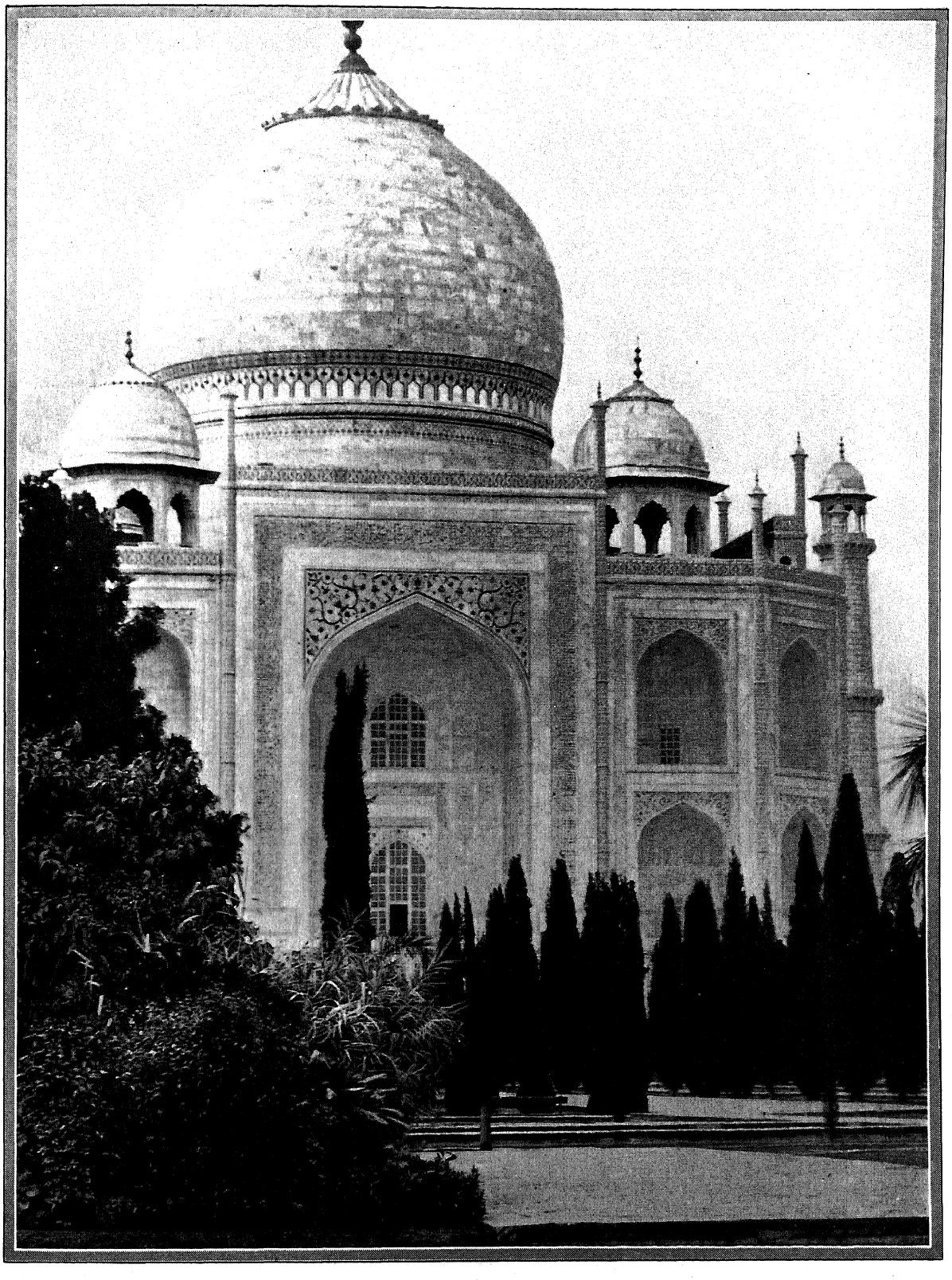
1. Stowitts, the artist, here depicts a cotton spinner using the wheel which Gandhi made the symbol of nationalism. 2. Fresco by Stowitts of a woman grinding flour to be made into unleavened bread.



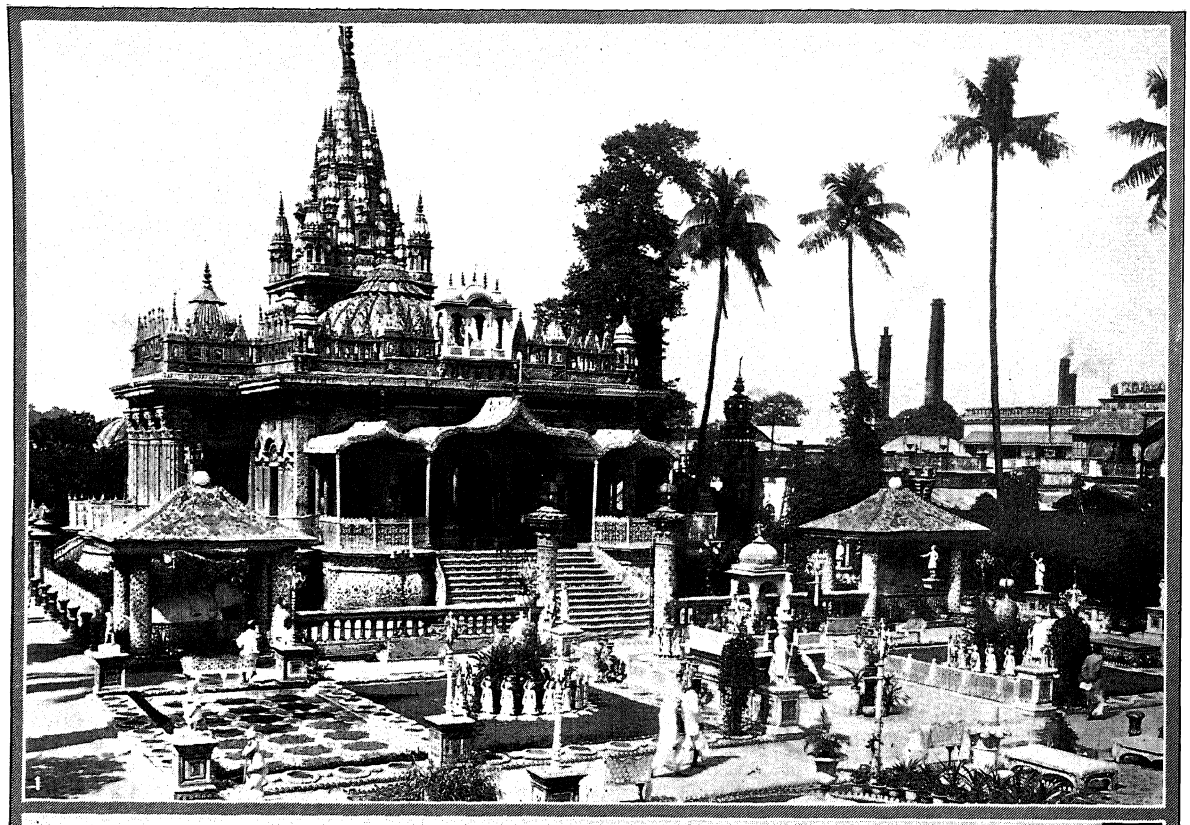
COURTESY THE INDIA STATE RAILWAYS

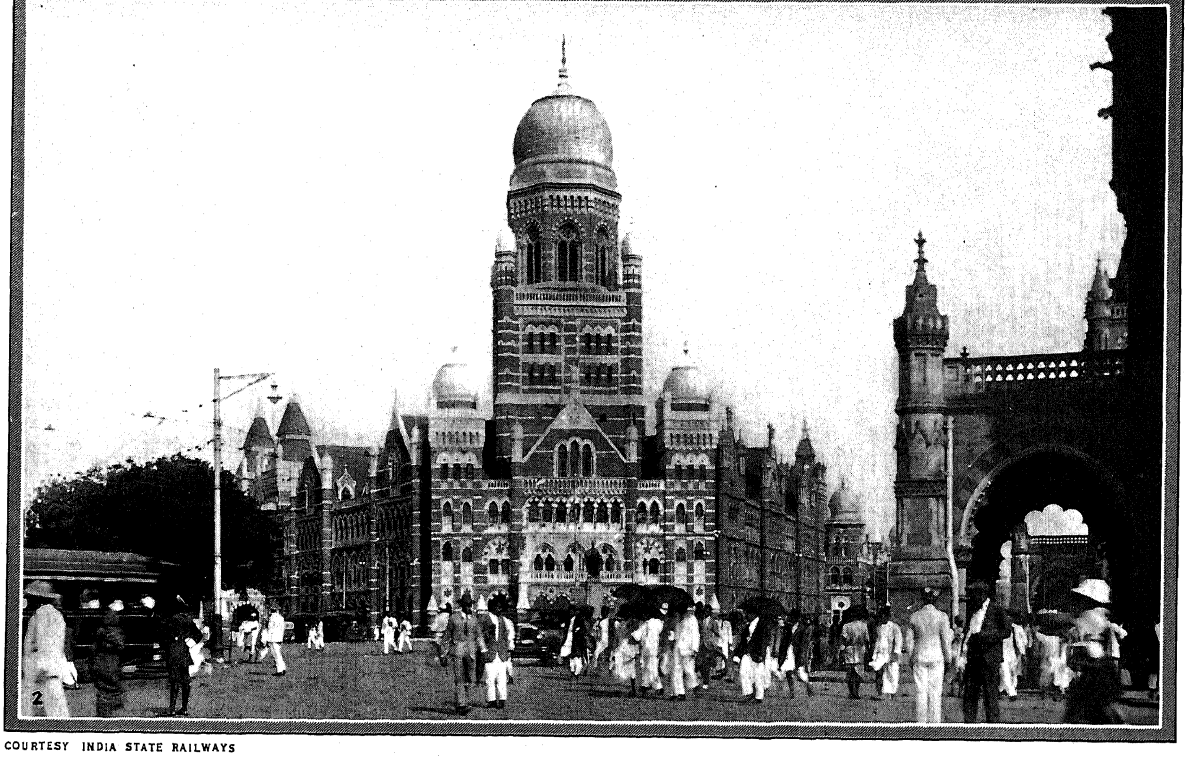
STREET AND TEMPLE SCENES OF MODERN INDIA

1. Kailasa Temple at Ellora, carved out of the rock. **2.** Mohammedans praying at the shrine of Nizam-ud-din, Delhi. **3.** Carving ivory in the streets at Delhi. **4.** Kutb Minár at Delhi, a Mohammedan monument built about 1503.



NEAR VIEW OF THE FAÇADE AND DOME OF THE TAJ MAHAL, AGRA, INDIA





COURTESY INDIA STATE RAILWAYS

OLD AND NEW IN CALCUTTA AND BOMBAY

1. Jain Temple in gardens of Badri das at Calcutta. **2.** Municipal Building, Bombay.

building up the British Indian Empire was made by the victory at Plassey in 1757, in which a small force under ROBERT CLIVE defeated the troops of one of the rajahs. Clive dominated British interests in India until 1767. Five years later he was followed by WARREN HASTINGS, who held control until 1785. These two men laid down the foundations for British expansion in India. Their policy was to use force judiciously and as circumstances required, but at the same time and whenever practicable to secure essential control through winning and keeping the allegiance of the heads of semi-independent Indian states. During the century which followed Clive's retirement, the British territory was steadily expanded, the reasons usually given for annexation of new territory being the necessity of protecting British holdings. Wars with Burma in 1826, 1852, and 1885 brought that country into the British sphere. Clashes occurred with the border peoples on the north, particularly the Afghans, but partly to avoid trouble with Russia Afghanistan and Nepal were left at least nominally independent. Various revolts occurred within India, which were put down.

Until 1858, the British East India Company (chartered by Queen Elizabeth in 1600) rather than the British government acted for Britain in India. With the growth of British interests, and since British naval forces frequently became involved in the fighting in addition to the forces of the East India Company, this situation became increasingly unsatisfactory. The Sepoy mutiny, in 1857, brought the difficulties to a head. The next year the control of Indian affairs was taken out of the hands of the company by Parliament, and the administration was placed directly under the government at London. The announcement of this change of status was accompanied by a promise that steps would be taken to give the Indian peoples a larger share in the administration of their own affairs.

Nationalism Develops. The development of contacts with the outside world, the teachings in the missionary and other schools in India, and similar influences had led to the beginnings of a Nationalist movement in India during the first part of the nineteenth century. Almost immediately following the 1858 change in administration, this movement took on new life. It was partly religious, partly political. All through the latter half of the nineteenth century and into the twentieth the movement grew. Scores of religious leaders appeared, preaching the need for a new Hinduism, for an elimination of castes as contradictory to the principle that all men were essentially equal, for a new religion which would combine the best of all. Some of these men attained much influence in India and not a little abroad. If only the right sort of religious life could be established, other difficulties would disappear, they said—but when the question was raised of what the right sort of religious life was, agreement ceased. Many organizations were formed with the ideal of uniting India religiously, only to split up into rival factions. The movements for religious reform gradually took on political aspects. The government and private individuals established universities and other schools. An increasing number of Indians went abroad to study. As the number who had some knowledge of western ideas increased, the demand grew for the application in India of some of the principles of democracy.

These forces reacted on one another, with the result that an unorganized but vociferously expressed demand for a share in the government had developed in India by the beginning of the World War. This was so strong that many, in India and England, seriously feared that the Indians would seize the opportunity to start a widespread anti-British revolution in India while Britain was busy with the war. Wiser councils prevailed, however, partly because Britain in 1909 had given the Indians a real share in affairs, partly because the more responsible people in India realized that the British had done a great deal for the country and that the people were better off under British rule than they ever had been before, and partly because the heads of the great native states had been won over to sincere loyalty to the British crown by the treatment which they had received. Instead of turning against Britain in her time of need, the Indians rallied to her support, and expressed that support by sending large bodies of soldiers to join the British armies and by making substantial money gifts.

Administrative Readjustment Proceeds. The British, on their side, in the meantime had moved slowly forward in improving conditions in India. They kept control in their own hands (they still have that control); but they built roads and irrigation systems, established and maintained order, kept the taxes lower than they had been for centuries, opened schools of all grades, and in many other ways made their despotic control a distinctly benevolent one. The Minto-Morley reforms of 1909 were a long step forward in the political field; in the army changes were made which permitted Indians to become commissioned officers, whereas previously all the commissioned officers had been British; in the civil service increasing numbers of Indians were admitted and Indians were given steadily more responsible posts. The British moved much more slowly than the more outspoken Indians demanded, but they did move.

The war period, 1914-1918, was a peculiarly critical one. The British military forces were reduced to a minimum. The entrance of Turkey on the German side created a difficult problem for the Mohammedans in India. The talk of the allies about the need for overthrowing autocracy and saving democracy echoed throughout India, as did President Wilson's statements concerning national self-determination. The political peace which had been established by agreement between the Nationalist leaders and the government when the war broke out, lasted not quite two years. The National Congress, a non-official body of Indians representing and leading the Nationalist po-

litical movement, resumed activities. A group of elected members of the central legislative council proposed various changes in the government which would have given ultimate authority to an elected Indian body. At the end of 1916 the National Congress and the Muslim League agreed on a minimum set of reform demands. Early in 1917 the campaign for home rule was re-opened vigorously in all the provinces.

Meanwhile, in 1916, the British viceroy in India, Lord Chelmsford, had submitted to the British cabinet a set of reform proposals. He asked for a definite statement of policy, particularly on the question of whether India might look forward to responsible self-government. The secretary of state for India, Mr. E. S. Montagu, officially stated in the House of Commons on Aug. 20, 1917, that the British policy was to work toward responsible self-government for India, but added that the British authorities must be the judges of what advances should be made, and when. Early in the spring of 1918 German and Turkish advances and the collapse of Russia made the war situation peculiarly critical for Britain in the East. The British premier appealed to the Indian people to increase their efforts. Lord Chelmsford called a conference of the ruling princes of the native states and representatives of the various nationalist groups. Once more India responded. The conference took steps to give the increased support which Britain needed. The Nationalist agitation was suspended.

The Post-War Period. The armistice brought both rejoicing and a renewal of political agitation. Investigation had revealed the existence of a revolutionary conspiracy. The so-called Rowlatt anti-sedition bills were drafted and published in Jan., 1919. These were extremely reactionary, and their publication was followed immediately by a storm of protest from the Nationalists. Mahatma Gandhi launched a passive resistance movement—Gandhi already was widely known and revered as an ascetic and a holy man. The viceroy approved the bills, and Gandhi proclaimed a day of mourning. Popular feeling reached fever heat, and violence broke out. The Amritsar incident on Apr. 13, 1919, in which some 400 were killed and many more were wounded when General Dyer ordered his troops to fire on an unarmed gathering, added fuel to the flames.

Meanwhile, the British government went ahead with its plans for administrative changes in India. In the course of the summer of 1919, Parliament considered and in due course passed the bill putting into effect the Montagu-Chelmsford reform proposals. These changes by no means satisfied the Nationalists in India, since they left final authority in legislation, administration, and finance with the governor-general who was responsible to London. The Amritsar affair, the stern measures used to put down the public demonstrations in 1919, and the debate early in 1920 in the British Parliament over these matters, which showed that many of the British felt that insufficiently severe measures had been used—all these stirred new anti-British feeling. The Mohammedans were aroused by the terms of the peace treaty which the allies made with Turkey, by which the Caliph lost his temporal power. In the summer of 1920, Gandhi announced a program of non-violent non-coöperation with the government, and declared that the actions of the British authorities had destroyed his respect for them. At the National Congress meeting in Dec., 1920, Gandhi was made virtual dictator of the movement, and his non-coöperation campaign swept the country.

In Aug., 1921, a fanatical and ignorant Mohammedan tribe, the Moplahs, in Madras province, excited over the settlement with Turkey, broke into rebellion and attacked first the Europeans and then the Hindus. The uprising was put down, but it ended the coöperation between the Mohammedans and the Hindus in the Nationalist movement. In 1923 a group of the Nationalists broke away from Gandhi, secured election to nearly half of the seats in the central legislature, and put into effect a program of obstruction of everything the government wanted. The governor-general was forced to use his emergency powers. Thus an effective Indian organization had developed within the administration itself, supplementing though not working with the Gandhi-led non-coöperation movement outside. The next election, in Nov., 1926, brought into the central legislature two Nationalist groups and a Mohammedan group. The Nationalists have consistently opposed all government measures; the Mohammedans, chiefly from ill-feeling toward the Hindus, have sided with the government. These Mohammedan votes, with those of the appointed members, have given the government its majority in most cases.

Meanwhile, Gandhi's non-coöperation movement had waned somewhat, but had secured the adherence of the followers of a reform movement among the warrior Sikhs. The Sikh reform was primarily religious; the reformers, like so many others in India, found in Gandhi's religious asceticism and doctrines much that appealed. In many ways, in fact, Gandhi is directly in the line of religious reformers down through Indian history. His name in western countries has been more associated with politics than with religion, but religious faith and conviction are the driving forces in the man himself, and the qualities which make his influence so powerful.

The next move by the British came with the appointment in 1927 of the SIMON COMMISSION, to formulate plans for further steps toward Indian self-government. No Indians were named as members of the Commission, with the result that Indian feeling was stirred anew. When the Commission got to India in 1928, it found the Indian leaders hostile in the main and entirely unwilling to coöperate. By the time the Commission's report was prepared and published, in the late spring of 1930, the Indian demands had moved forward so far beyond the comparatively moderate changes which the Commission

proposed that the proposals were not even brought before Parliament for serious discussion as the basis of a new bill dealing with the government of India.

Gandhi, on his part and leading the National Congress group, enlarged the scope of his movement. Besides insisting on non-coöperation with the British authorities, he began a campaign against what he called British economic domination in India. Specifically, he advocated reviving the use of the spinning wheel and the hand loom for producing cotton cloth in the ancient ways, as a means both of striking at the cotton mill industry in England and of restoring Indian economic independence. All his followers were urged to make the cloth for their own garments. Many thousands of them did. Gandhi also attacked the right of the British to financial control in India. In 1930 he himself made salt direct from the sea water, in direct and deliberate violation of the government salt monopoly regulations. This salt making was simply a gesture, but it was enormously effective in its appeal to the people to unite against British rule. Thousands formed themselves into bands to make salt in violation of the law, to spread the non-coöperation doctrine and otherwise to carry on the Nationalist campaign. Gandhi insisted that there should be no violence and no resistance to any attacks made by the police. The authorities felt compelled to take action. Many were arrested, including Gandhi himself. Gatherings of Nationalists were broken up by the police, who used clubs sometimes with recklessness and serious consequences. But with amazingly few exceptions, Gandhi's non-resistance orders were followed. The situation reached its climax in the spring and summer of 1930.

In November of that year a Round-Table Conference was held in London, attended by representatives of all classes of Indians. The discussions were friendly enough. The conferees agreed that a federation, including the native states, would be desirable in India. But nothing was done about the fundamental question of responsible self-government for India, nor toward working out a solution of the problem of Hindu-Moslem distrust. In any case Gandhi was not there—he was in jail in India—and no program in the drafting of which he did not play a part stood any chance of being accepted.

Better feeling developed between the Nationalists and the British authorities in 1931. Gandhi and the other Nationalist leaders were released. The Nationalists intimated that they might be ready to agree that India should have the status of a self-governing dominion within the British empire instead of complete independence. The British authorities, under the leadership of the Labor premier, Ramsay MacDonald, indicated that they were in effect ready to accept almost any practicable plan for administrative reorganization in India on which the Indians themselves could agreed. A second round table conference, this time with Gandhi present, met in London in the summer of 1931. The discussions dragged on, Gandhi demanding at least full dominion status and control over the Indian army as well as of Indian finances. The British insisted that Britain must keep control of the army and of foreign affairs, and enough financial control to insure the payment of India's public debts. They asked repeatedly that the Indians submit a draft constitution, at least as a basis for discussion, since the Indians had rejected the various plans which the British had put forward. But no such document was forthcoming. Finally the conference ended. No definite results had been secured. The Indian delegates went home, and a number of British commissions were appointed to go out to India to continue the study of the problem. Gandhi announced a renewal of the non-cooperation campaign. The British viceroy said that whatever steps were necessary would be taken to prevent disorder and stop civil disobedience. Gandhi's followers, while engaged in a demonstration, were attacked by the police. Gandhi was jailed. The fight was on with new intensity as 1932 began. (*See* bibliography for INDIA.) G. C.

INDIA, ROUND TABLE CONFERENCE ON, the name applied to two meetings of English and Indian delegates in London between Nov. 12, 1930 and Dec. 1, 1931 to discuss plans for changes in the government of India. Since 1921 India has been governed under a Parliamentary Act granting a Constitution providing for a partial self-government and containing provisions for its revision after 10 years. The Viceroy, Lord Irwin, stated at Delhi, Oct. 31, 1929, that "it is implicit in the Declaration of 1917 that the natural issue of India's constitutional progress . . . is the attainment of dominion status." The following day the British Government agreed to grant dominion status, but as they fixed no definite date, the Indians doubted their good faith.

Shortly afterwards, at a meeting of the All India Congress, a purely deliberative body, under the influence of Mahatma Gandhi the Nationalists passed a resolution demanding complete independence, which they thought could be obtained by non-violent civil disobedience. Upon the Government's refusal to grant dominion status immediately, civil disobedience and boycotting of British goods was soon in full swing. Non-violence soon gave way to violence as the movement gained momentum, and Gandhi's arrest followed, May 5. The English Government, however, continued to study the question of India's self-government. Lord Irwin suggested, July 9, that a Round Table Conference meet in London, at the same time informing the Indian Legislature that the British Government would not promise to meet the Nationalist demands. The Nationalists then demanded that Britain pledge itself in advance to grant dominion status with the right to secede from the Empire at any time, that India be given economic and military control of the National Government, and that the Indians be permitted to choose their own delegates rather than have them nominated by the Viceroy. The negotiations with the Nationalists failed in September, and the Government announced that the Conference would meet in October. Meanwhile,

violent Nationalist demonstrations gradually subsided.

The first Round Table Conference opened in London, Nov. 12, 1930, attended by 16 British statesmen and 76 moderately minded Indians nominated by Lord Irwin. The nationalist leaders were not represented. It was soon evident that all Indian delegates desired responsible self-government, and the princes showed a willingness to enter a federated Government. Although the bitter hatred between the Moslems and the Hindus led to such an uncompromising attitude that any agreement seemed impossible, the general outlines of a federal plan and a draft of a Constitution were worked out. Because of the difficult problem of protecting Indian minorities, the question of self-government remained unsettled. The first conference came to an abrupt end Jan. 19, 1931.

Gandhi, released from prison early in 1931, soon arranged with the Viceroy a truce between the Indian Government and the Nationalists, and agreed to have the Congress Party represented at a second conference. After vacillating most of the summer, Gandhi finally decided to go to London as the sole representative of the National Congress. The change in Government in England in Aug. 1931 brought in control a group who were in favor of a strong hand in India, and a settlement seemed farther away than ever. Gandhi arrived in England late in the autumn, and the work of the conference was resumed. Meanwhile, terrorist crimes in Bengal constantly increased. The National Congress was charged with being behind the outrages, and the Government issued a severe ordinance giving itself wide power to stamp out terrorism. The conference finally broke down on the question of minorities. The failure was due, also, to the fact that the Indian delegates were not united in their aims. The Moslems were more insistent than ever in their demands for assurances of protection and freedom from Hindu control, and the settlement of the treatment of the "depressed classes," the "Untouchables," proved to be a major hindrance to an agreement. The conference broke up Dec. 1, 1931. Upon his arrival in India, Dec. 28, Gandhi requested an interview which was granted by the new Viceroy, Lord Willingdon, Jan. 1, 1932, who at the same time refused to discuss the ordinance. The civil disobedience campaign recommenced almost immediately. Gandhi and the Government began a rigorous suppression of the National Congress movement.

An all-India Moslem League which met at Delhi, Dec. 27, affirmed its opposition to the campaign of the Indian National Congress, and declared in favor of a responsible Government with adequate protection for the Moslems. Mohammedan attacks on Hindus added to the unrest in India. In spite of the desperate situation, several Round Table Conference Committees were appointed just before Christmas, to continue working on the problem. A. P. W.

INDIAN, MODERN, a group of languages of the Indian branch of the INDO-IRANIAN linguistic family spoken in the northern half of India by 229,560,555 persons (in 1921) and divided by the Linguistic Survey of India into 17 languages and 345 dialects, all descended from dialects of Apabhramça (vernacular) PRAKRIT, and thus closely akin to SANSKRIT and PALI. The languages are Outer Sub-Branch—Assamese, Bengali, Bihari, Oriya, Marathi, Sindhi, Lahnda; Mediate Sub-Branch—Eastern Hindi; Inner Sub-Branch—Naipali (or Eastern Pahari), Central and Western Pahari, Panjabi, Western Hindi, Rajasthani, Bhili, Khandeçi, Gujurati; to which must be added Simhalese, spoken in the southern half of Ceylon, and ROMANY or Gypsy. Most of these possess literatures, especially in religious and bardic poetry, influenced often to excess by artificial Sanskrit models. Western Hindi, or Hindustani (called Urdu, or "camp-language," when mixed with Arabic, Persian and Turkish words), is the *lingua franca* for all northern India. Generally speaking the group shows the same tendency to evolve an analytic type of inflection from an inflectional stage as is seen in ENGLISH when compared with Anglo-Saxon. The Outer Sub-Branch, however, is passing beyond that position, and is so incorporating the various auxiliaries as again to create a true inflectional system. The past active tense, still found in Sanskrit, Prakrit and Pali, tends to be replaced by a passive construction of the type "the man (was) struck by me" instead of "I struck the man." L. H. G.

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INDIANA, one of the middle western states of the United States, popularly called the "Hoosier State." It is situated between 37° 47′ and 41° 50′ N. lat. and 84° 49′ and 88° 2′ W. long. On the north it is bounded by Michigan and Lake Michigan, on the east by Ohio, on the south by the Ohio River which separates it from Kentucky, and on the west by Illinois. Indiana comprises an area of 36,354 sq. mi. including 309 sq. mi. of water surface. In size it ranks thirty-seventh among the states of the Union.



INDIANA STATE SEAL

Surface Features. Indiana lies within the great central lowland. Its surface is a slightly varied plain having a mean elevation above sea level of 700 ft. In Randolph County on the eastern border the altitude reaches 1,240 ft., and in Vanderburg County along the Ohio River declines to 316 ft. Rugged and rolling regions occur in the unglaciated southern portion of the state and in the northeastern corner where terminal moraines are found. Steep bluffs form the banks of the main streams, and a broad expanse of sand dunes and marshes lies just south of the Lake Michigan shore.

The entire state slopes toward the southwest and

is drained into the Mississippi River through the Wabash, White and Ohio rivers. Numerous small lakes are scattered over the northern part. In the limestone region of southern Ohio are caves cut by subterranean streams, and mineral springs of which French Lick and West Baden are widely known.

Climate. Except the usual contrasts between summer and winter, characteristic of an interior situation, the climatic conditions prevailing throughout Indiana are otherwise remarkably uniform. The mean annual temperature is 52.4° F. At Indianapolis the average for January is 28.4° F. and for July 75.7° F. During the period, 1887-1930, the highest temperature recorded in Indiana was 113° F. and the lowest, —33° F. The average annual precipitation is 39.3 in. At Indianapolis the average date for the last killing frost in spring is April 16 and that of the first killing frost in autumn is October 19, giving an average growing season of 186 days or about equal in length to that of southern Illinois, Missouri and eastern Kansas.

Forests and Parks. Approximately seven-eighths or 19,840,000 acres of the land area of Indiana originally formed a part of the hardwood belt and contained good stands of oak, walnut, ash, beech, birch, hickory, elm and maple. With the exception of the rugged unglaciated region in southern Indiana the forests have been largely cut over. Much second-growth occurs and reforestation projects on farm woodlots are being carried out. The Clark County State Forest of 5,240 acres in southeastern Indiana is a rough and broken region timbered with second growth hardwoods and Jersey scrub pine. It contains an experimental nursery and has picnic grounds and camp sites. Indiana has nine state parks which preserve exceptional and characteristic types of scenery. Outstanding among these are POKAGON and TURKEY RUN. The DUNES STATE PARK, along the shores of Lake Michigan, is nationally famous. The state parks were acquired and developed by appropriation or gift but are made self-supporting by means of small entrance, camping and other incidental fees. Two game preserves, the Brown County and Kankakee with an area of 14,559 acres contain fur-bearing animals, prairie chickens, pheasants, quail and grouse. Five state monuments include the Nancy Hanks Lincoln Burial Ground, an 85-acre tract which covers part of the Lincoln Farm.

Minerals and Mining. The chief mineral resources of Indiana are its bituminous coal fields, embracing an area of about 6,500 sq. mi. in the southwestern part of the state, and exceedingly valuable deposits of high-quality limestone, the Bedford stone quarried in Lawrence and Monroe counties ranking among the best American building stones.

With mineral productions in 1929 amounting to $96,961,947, Indiana stood fifteenth among the states, ranking first in building stone produced, second in limestone, fourth in cement and seventh in coal. The leading products in order of value were coal, $31,501,936; stone, 5,129,220 tons, $22,191,883, including limestone, $12,247,196; clay products, $18,503,240; cement, about $17,000,000; sand and gravel, $4,452,720; and petroleum, 981,000 bbls., $1,610,000. Among minor products were lime, natural gas, clay and molding sand.

During 1929 452 mines and quarries gave employment to 18,279 persons who received $26,448,708 in salaries and wages.

Soil. Consisting largely of a glacial drift deposit, the soil of Indiana as a whole is exceptionally fertile. The richest section is the valley of the Wabash River; the least fertile region is a belt just south of Lake Michigan where the soil is sandy and gravelly. In southern Indiana, especially along the Ohio and White rivers, there are soils formed by the decomposition of sandstones and limestones. The rich alluvial deposits of the river bottoms are unsurpassed for the production of grain.

Agriculture. In proportion to its area Indiana ranks high in crops produced, chiefly grains, hay, vegetables, fruits and tobacco.

In 1930 19,688,675 ac. or 85.3% of the entire land area was in farms, 181,570 in number, with an average size per farm of 108.4 ac. and an average value per acre of $71.90. Of the farm area 11,722,236 ac. or 60% was crop land; 5,956,416 ac. or 30%, pasture land; and 785,611 ac. or 4%, woodland. The total value of farm property was $1,677,992,919, of which $1,415,542,192 was represented by lands and buildings; $86,778,440, by implements and machinery; and $175,672,287, by domestic animals.

According to the census of 1930 Indiana produced in 1929 field crops to the value of $198,058,384, ranking seventeenth among the states. It stood fourth in corn, seventh in oats, eighth in rye and twelfth in wheat and tobacco; it also ranked fourth in onions, seventh in tomatoes and twelfth in all vegetables harvested for sale. The chief crops were grains valued at $137,668,776; hay and forage, $30,095,378; vegetables, $20,999,696; fruits, $4,696,746, and tobacco, 15,901,768 lbs. grown on 19,372 ac. and valued at $2,703,301.

Corn, oats and wheat are the leading grain crops. Of 4,220,931 ac. devoted to corn, 3,675,946 ac. harvested for grain produced 114,871,320 bu. and 132,733 ac. cut for silage yielded 907,152 tons. Oats, grown on 1,661,155 ac., yielded 47,465,387 bu., and wheat, grown on 1,533,031 ac., 25,190,384 bu. Other grain crops were rye, 1,103,213 bu., and barley, 688,045 bu. Of the hay crop of 2,450,101 tons, timothy and clover contributed 1,829,969 tons or 74%.

Among the vegetables were potatoes, $6,218,169; tomatoes, $2,790,611; onions, $1,465,683; sweet corn, $747,482, and sweet potatoes, $524,938. The chief fruits were apples 1,084,592 bu., peaches 978,211 bu., pears 184,907 bu., strawberries 5,656,078 qts., and grapes 4,875,570 lbs.

Farm products sold by cooperative marketing rose from $12,778,040 in 1919 to $16,687,604 in 1929, and farm supplies purchased by this method, from $1,766,263 to $3,463,461. Farm machinery and equipment in 1930 included 154,556 automobiles, 30,037

motor trucks, 41,979 tractors, 11,030 electric motors, and 39,380 stationary gas engines.

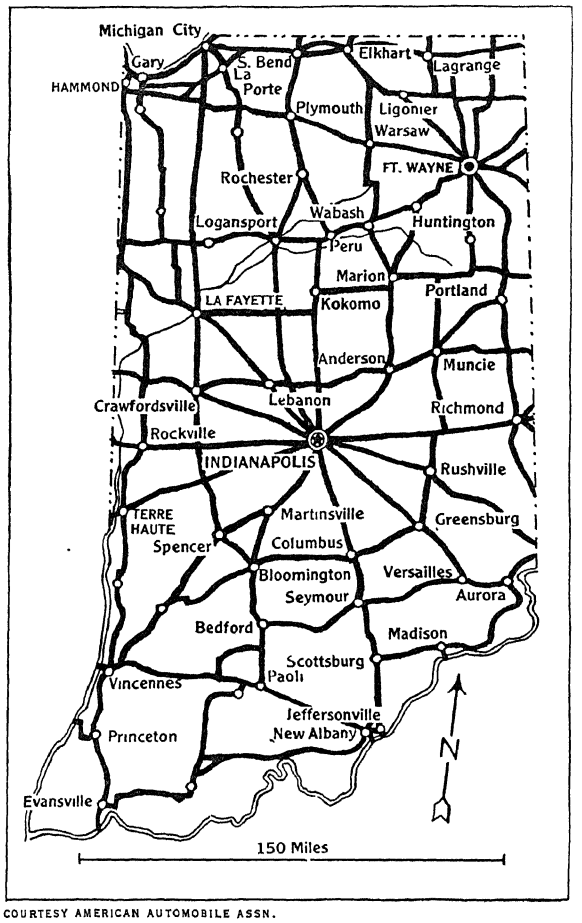
Animal Industry. Cattle-raising, chiefly for milk production, hog-raising and poultry growing are the principal livestock interests. According to the census of 1930, the rank of Indiana among the states was fifth in swine, seventh in chickens raised, tenth in chicken eggs produced, and twelfth in milk cows and milk production. The state stood fourteenth in the total value, $175,672,287, of domestic animals. Among these were 1,446,747 cattle reported from 159,746 farms or 88% of all farms in the state and valued at $77,791,279; horses, 443,411 in number valued at $35,270,488; mules, 81,988, $7,181,976; swine, 3,347,256, $34,241,202, and sheep, 1,118,184, $8,469,702.

Of the cows on farms, 738,427 were kept mainly for milk production and 80,598 mainly for beef production. In 1929, 332,182,790 gals. of milk were produced; the total value of dairy products sold was $50,173,766. The value of all poultry raised was $27,951,256. The number and value of the chief kinds were chickens, 29,047,735, $26,872,692; ducks, 464,744, $429,882; turkeys, 129,742, $400,190, and geese, 145,655, $248,492. The chickens sold, 14,088,357 in number, were valued at $13,427,395. Of 103,539,916 doz. chicken eggs produced, valued at $30,275,817, 80,987,191 doz., with a value of $23,680,644, were marketed. The sheep industry yielded 3,980,614 lbs. of wool valued at $1,387,451. Honey, amounting to 2,155,528 lbs. valued at $400,353, was produced from 91,976 hives.

Fisheries. In 1930, the commercial fish catch amounted to 5,687,000 lbs., valued at $327,000, the most important species being buffalo fish, carp and catfish. A considerable quantity of mussel shells are taken for the button industry. The state issued 320,674 fishing licenses in 1930 and received $307,444.20 in fees. Five hatcheries, employing 15 men, are operated at an annual cost of $63,998. The output in 1930 was 714,360 bass and 8,491,350 other game fish. Plantings in state waters by the United States Bureau of Fisheries included 32,400 rainbow trout, 54,000 brook trout, 3,750 crappie, 3,500 large mouth black bass, 192,300 small mouth bass and over 20,000 of other species.

Transportation. Indiana has fairly good facilities for transportation by water. The Ohio River forms the entire southern boundary of the state, and the Wabash, penetrating the state, is navigable as far as Lafayette. However, the northern and central portions of the state were handicapped by lack of water routes during their early development. This need gave rise, in 1843, to the construction of the Wabash and Erie Canal which ran from Fort Wayne to Lafayette, connecting with the Wabash and Ohio rivers, and northeastward to join Ohio's Cincinnati-Toledo Canal. The White Water Canal, from Hagerstown, along the White Water River, to Lawrenceburg, on the Ohio River, was completed about the same time. Although these routes were of great importance in their time, they were later superseded by the steam railways. Indiana is now served by practically all the transcontinental systems entering Chicago from the east, as well as important north and south lines. These form an efficient transportation network. The total railway mileage in 1930 was 7,105.

The highway system shows steady extension and improvement. On Jan. 1, 1930, there were 124,975 mi. of highways, including 51,314 mi. of surfaced roads and 4,962 mi. of state highways. The total



COURTESY AMERICAN AUTOMOBILE ASSN.

INDIANA STATE ROADS

highway expenditure during 1929 was $48,286,104, of which $20,677,796 was paid by the state and $27,608,308 by county and local governments. The state gasoline tax produced a gross revenue of $17,158,834 in 1930. Motor vehicle registrations were 875,763 in 1930, compared with 725,410 in 1925. The growth of trucking facilities is shown by a registration of 128,397 trucks in 1930, as against 94,856 in 1925. During the same period, the number of buses in operation increased from 2,731 to 7,071, or nearly 160%.

Manufactures. Indiana is surpassed in manufactures only by Illinois and Michigan among the states of the Middle West. Its extensive factory industries have been aided in their development by abundant supplies of coal and the central position of

the state in a populous region, the early discovery of natural gas, and by excellent transportation facilities, both by rail and by water, utilizing the Great Lakes system for the transportation of iron ore and the Ohio River connections for distribution southward.

According to the Census of 1930 Indiana with manufactures for 1929 valued at $2,539,893,849 stood ninth among the states. Its 5,091 establishments gave employment to 45,190 officers and employees, who received $115,415,151 in salaries, and to 314,698 wage earners, who were paid $418,771,109 in wages. These factories used a total of 1,858,735 horse power, expended $124,613,967 for fuel and power, and $1,278,817,190 for materials and supplies, and added by the process of manufacture $1,136,462,692 to the value of their output.

This output included some 130 separately enumerated products. The state stood third in iron and steel rolling mill products, electric and steam railway cars and coke; fourth in gas and electric fixtures, pig iron, furniture and glass; fifth in motor vehicles, motor vehicle bodies and parts and steam railroad carshop construction and repair; sixth in foundry and machine shop products; seventh in canning and preserving and in electrical machinery, eighth in knit goods and paper boxes, ninth in planing mill products, tenth in the printing and publishing of newspapers and periodicals and flour milling, and eleventh in meat packing.

The leading manufacturing industries were those connected with the production of iron and steel and motor vehicles. In value these formed more than one-fourth of the state's factory output, the former producing about 16% and the latter 12% of the total. The principal factory industries, which produced 60% of the total manufactures, in order of value of output were:

Product or Industry	*No. Persons Employed*	*Value of Products $*
Iron and steel rolling mill products	31,689	334,127,376
Motor vehicles	22,793	208,247,058
Foundry and machine shop products	30,494	153,406,243
Electrical machinery	23,612	133,352,549
Meat packing	5,940	99,906,829
Motor vehicle bodies and parts	14,854	90,128,727
Furniture	20,709	83,495,716
Pig iron	1,710	74,180,193
Electric and steam railway cars	6,243	55,211,532
Printing and publishing	11,675	53,360,688
Coke	1,761	53,261,243
Steam railway carshop construction and repairs	16,351	50,009,319
Bread and bakery products	5,556	34,502,346
Glass	8,004	34,490,483
Canning and preserving, fruit and vegetable	5,406	33,708,690
Knit goods	6,506	32,153,951
Wire	5,238	31,037,566
Flour	1,295	30,116,049

The outstanding manufacturing district is Lake Co., bordering on Lake Michigan and containing the great iron and steel works at Gary and important industrial plants at Indiana Harbor, Hammond and East Chicago. The output for this county in 1929 was valued at $807,000,000, or about one-third of that of the entire state. Of major importance also is Indianapolis, dependent entirely on railroad transportation, with products valued at $400,000,000. Other important manufacturing cities in order of value of output were East Chicago, $214,000,000; South Bend, $163,000,000, and Fort Wayne, $122,000,000; Evansville, including all of Vanderburgh Co., $99,000,000; Anderson, $85,000,000; Hammond, $71,000,000, and Muncie, $66,000,000.

Commerce. According to the census of 1930, there were in 1929 3,734 wholesale establishments in Indiana, with total sales of $921,561,046. These organizations gave full-time employment to 25,474 men and women, whose salaries for the year aggregated $43,258,210. The chief wholesaling center is Indianapolis, with Ft. Wayne and Terre Haute also important.

The sales of the 41,796 retail stores amounted to $1,229,294,386. Sales per store averaged $29,412; sales per capita were $379.59.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	*No. of Stores*	*Sales*	*% of Total*
Foods	11,828	$280,629,283	22.82
Automotive	7,873	271,963,051	22.11
General Mdse.	3,587	189,414,310	15.41
Lumber & Bldg.	2,587	101,501,631	8.26
Apparel	2,615	90,825,871	7.39
Furn. & Household	1,255	55,152,330	4.50
All other stores	12,051	239,807,910	19.51
Total, all stores	41,796	$1,229,294,386	100.00

Finance and Banking. The assessed value of all property in 1929 was $5,166,896,475. Indiana had no bonded debt in 1930. Total revenue receipts in 1930 were $56,628,628, with the chief sources of revenue gasoline taxes, $14,033,741; property taxes, $11,738,678; fees, including motor vehicle fees, $9,847,467; Federal highway aid, $2,950,671, and insurance taxes, $1,991,438. Total expenditures were $59,111,714, with the largest items highway construction and maintenance, $20,594,686; aid to benevolent institutions, $6,862,135; universities, $7,510,491, and schools $5,056,423.

There were 852 banks in Indiana in 1930, of which 195 were national banks, 578 state banks and trust companies, and 79 private banks. Their total capitalization was $72,860,800; their surplus and undivided profits, $65,567,000. Total resources were $1,178,355,000 with loans and discounts aggregating $604,987,000. Demand and time deposits including postal savings totaled $664,845,000. Per capita demand and time deposits were $205.64; per capita savings deposits $85.19. The total savings of $275,435,000 were owned by 511,476 depositors. National bank circulation aggregated $23,459,000.

Government. The law-making power is vested in a general assembly composed of a senate of 50 members and a house of representatives of 100 members, meeting in biennial sessions limited in duration to 61 days. Senators are elected for terms of four years, representatives for terms of two years. The

chief executive is the governor, elected for a term of four years, but ineligible to succeed himself. Administrative officers are a secretary, auditor, and treasurer elected for two-year terms, and not eligible to office more than four years out of six. Judicial power is vested in a supreme court, appellate court, circuit court, probate, juvenile and superior courts. The supreme court consists of five judges elected for terms of six years at salaries of $7,500 per annum.

Social Welfare Institutions. A Board of Charities appointed by the governor administers Indiana's social welfare institutions, among the best run and best systematized in the Union. There is an habitual criminal law and a sterilization law for mental degenerates and confirmed criminals. Institutions for the feebleminded are maintained at Ft. Wayne and Butlerville, and for epileptics at Newcastle. There is a girls' reform school at Indianapolis and one for boys at Plainfield. At Lafayette is a soldiers' home and at Knightstown a soldiers' orphans' home. Hospitals for the insane are located at Indianapolis, Logansport, Richmond, Evansville and North Madison. Indianapolis also has a university hospital. There is a state farm at Greencastle. Rockville has a state sanitarium. A reformatory is at Pendleton, a prison at Michigan City and a women's prison at Indianapolis.

Education. The first school was taught at Vincennes in 1793 by a French missionary, and the second school was opened in Charleston in 1803. In 1824 the first general school law of the state was enacted. In 1928-29, there were 3,858 public elementary schools having 503,875 enrolled pupils and 14,653 teachers. In the same period the 904 public high schools had 137,274 pupils and 7,319 teachers. Children from 7 to 16 years of age are required by law to attend school the full term. The number of persons from 5 to 20 years of age attending school in 1930 was 685,895, or 72.2% of the population within the ages specified, as compared to 563,523, or 65%, in 1920. The number of persons 10 years and over unable to read and write in 1930 was 43,721, or 1.7%, as compared to 52,034, or 2.2% in 1920.

The state institutions for higher education include Indiana University at Bloomington, Purdue University at Lafayette, a normal school at Terre Haute, and the Ball Teachers College at Muncie. Other widely known institutions of learning are De Pauw University at Greencastle, the University of Notre Dame, Butler University at Indianapolis, Wabash College at Crawfordsville, Valparaiso University at Valparaiso, the Central Normal College at Danville and the Teachers College of Indianapolis.

Population. In 1930 Indiana ranked eleventh among the states with a population of 3,238,503 or an average of 89.8 per square mile, an increase of 308,113 or 10.5% over 1920. The population rose from 147,178 in 1820 to 988,416 in 1850, 2,516,462 in 1900, 2,700,876 in 1910, and to 2,930,390 in 1920. In 1930 there were 3,116,136 or 96.2% whites and 111,982 or 3.5% Negroes, an increase of 9.4% whites and 38.6% Negroes from 1920. Of the whites, 2,981,002 were native born and 135,134 were foreign born, a decrease in the latter of 15,734 from 1920. Of the total foreign stock, including foreign born, foreign and mixed parentage, 184,520 or 36.2% were German; 51,616 or 10.1%, Polish; 31,549 or 6.2%, English; 30,821 or 6.0%, Irish. The urban population was 1,795,892 or 55.5% of the total, an increase of 313,037 or 21.1% from 1920; the rural population was 1,442,611 or 44.5% of the total, a decrease of 4,924 or 0.3% since 1920. In 1930 there were five cities with a population of 100,000 or over: Indianapolis, 364,161; Fort Wayne, 114,946; South Bend, 104,193; Evansville, 102,249; Gary, 100,426.

Occupations. In 1930 1,251,065 persons, or 38.6% of the population, were gainful workers 10 years old or older; 81.2% of these were males and 18.8% were females; 89.3% were native white; 5.9% foreign-born white; 4.3% Negro, and 0.5% other races. Of the females 15 years old or older 50.4% were single, 30.6% were married and 19% were widowed or divorced.

Among the principal occupations, with number of workers, were farmers, 166,483, and farm wage workers, 65,779; factory operatives, 80,549 men and 36,924 women, including 14,104 persons in clothing industries and 10,456 persons in automobile factories; factory laborers, 89,108, including 19,332 persons in steel works; salespersons, 37,531 men and 15,189 women; retail dealers, 41,518; clerks, 32,701 men and 18,406 women; servants, 36,208; building laborers, 33,189; schoolteachers, 7,452 men and 20,196 women; chauffeurs, 25,929; carpenters, 24,355; machinists, 23,370; bookkeepers and cashiers, 6,201 men and 14,180 women; stenographers, 549 men and 17,949 women; coal mine operatives, 15,406, and steam railroad laborers, 12,036.

HISTORY

French *coureurs de bois* and Jesuit missionaries, the first Europeans to visit Indiana, found it sparsely inhabited by Miami and Wabash Indians. The French, of whom LA SALLE was the first to leave definite traces of his exploration, were welcomed, made regular use of the Wabash-Maumee portage in journeys toward the center of the Mississippi valley, and built Ft. Ouiatanon, near Lafayette, in 1720, a fort at the head of the Maumee, and Ft. Vincennes in 1731. By 1735 several French families were settled about the post at Vincennes, the first permanent settlement and the only one until after the REVOLUTIONARY WAR. The British acquired control of the Indiana country, except Vincennes, which remained for several years under the jurisdiction of New Orleans, in the closing years of the FRENCH AND INDIAN WAR. British garrisons supplanted the French, and British influence penetrated the fur trade; otherwise there was little change. In 1778 Vincennes passed into American control (*see* CLARK, GEORGE ROGERS); the entire region was ceded to the United States in the TREATY OF PARIS, 1783, and organized under the terms of the ORDINANCE OF 1787. In 1800 the Northwest Territory

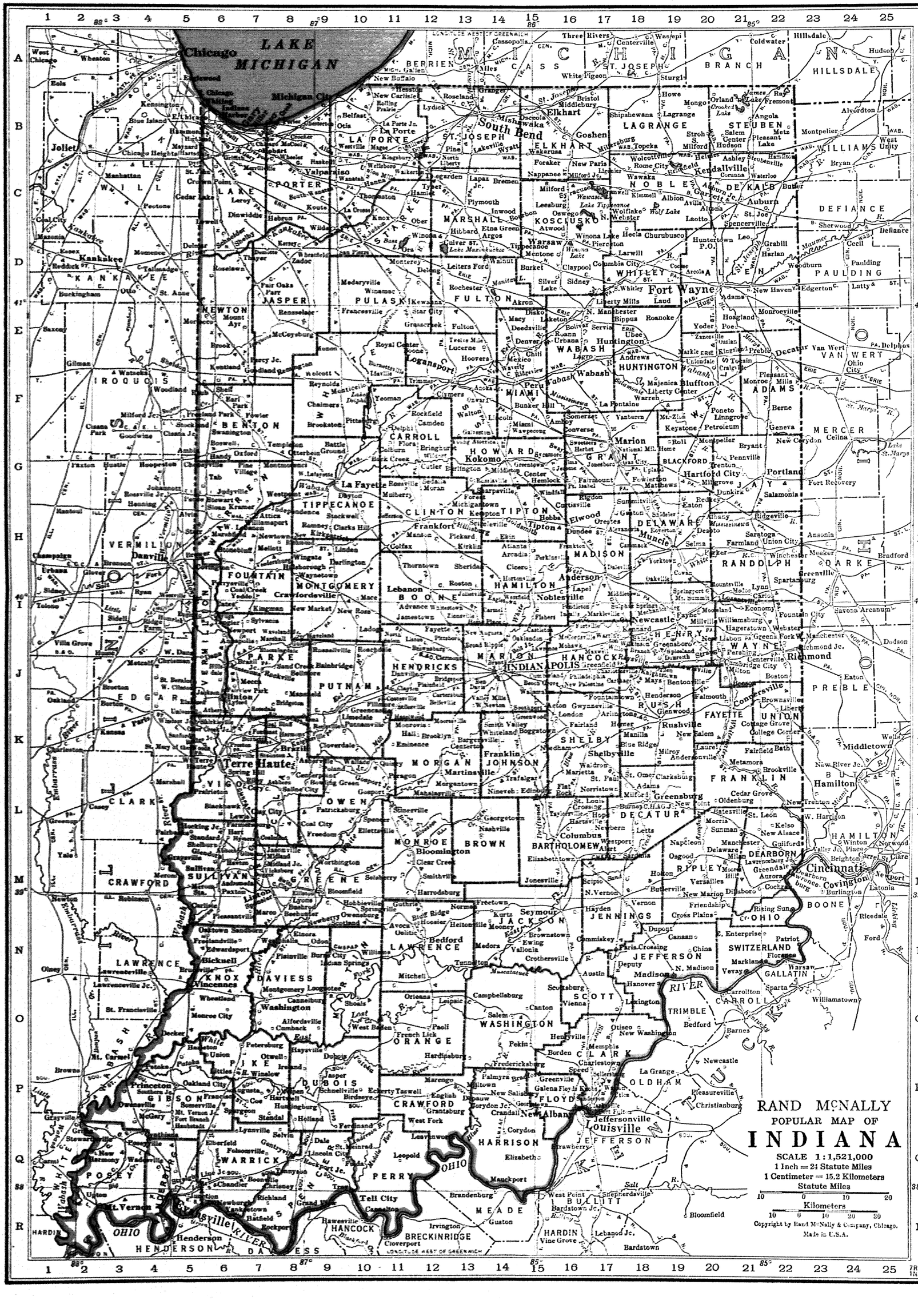
INDIANA

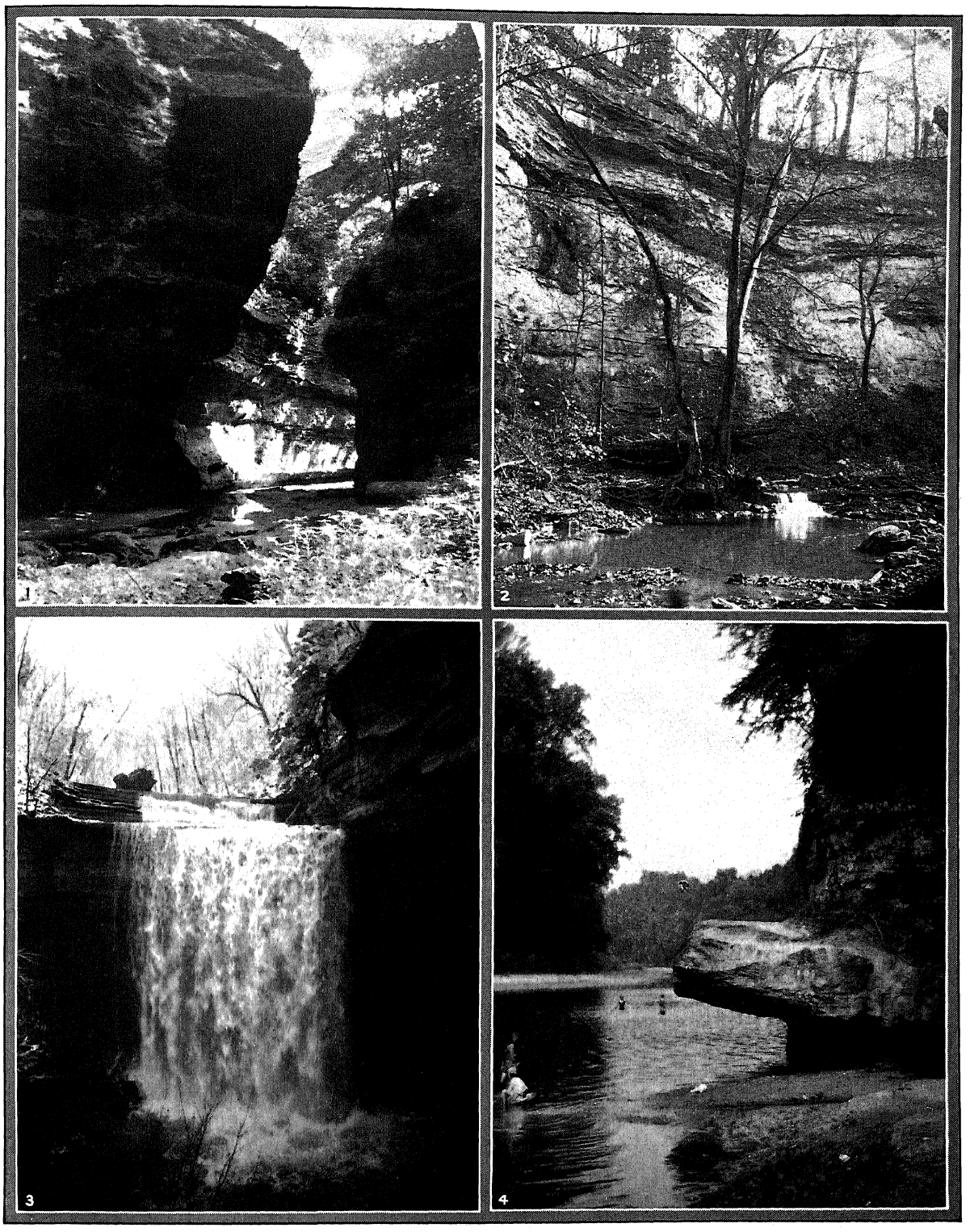
Area 36,354 sq. m.
Pop. 3,238,503

PRINCIPAL CITIES

Pop.—Thousands

4 Alexandria H 17
40 Anderson H 17
4 Attica H 7
5 Auburn C 21
4 Aurora M 22
9 Brazil K 8
8 Clinton J 6
4 Columbia City D 18
10 Columbus L 16
13 Connersville J 21
10 Crawfordsville J 9
4 Crown Point C 6
5 Decatur E 22
55 E. Chicago B 6
33 Elkhart C 22
11 Evansville H 15
102 Fort Wayne D 20
12 Frankfort E 13
6 Franklin K 15
4 Garrett C 20
100 Gary C 17
3 Gas City K 17
10 Goshen C 18
5 Greencastle J 10
4 Greenfield J 17
6 Greensburg L 18
65 Hammond B 15
7 Hartford City G 19
6 Hobart C 17
13 Huntington G 21
7 Indiana Harbor B 6
364 Indianapolis J 14
12 Jasper J 9
12 Jeffersonville L 17
5 Kendallville C 20
33 Kokomo G 14
261 La Fayette G 10
16 La Porte A 10
4 Lawrenceburg M 22
6 Lebanon J 13
5 Linton M 7
19 Logansport E 13
7 Madison N 19
25 Marion G 13
25 Martinsville K 12
27 Michigan City B 9
20 Mishawaka B 14
3 Mitchell N 12
47 Muncie H 19
3 Nappanee C 15
26 New Albany P 16
14 Newcastle J 19
6 Noblesville H 16
12 Peru F 13
5 Plymouth C 13
5 Portland G 23
8 Princeton J 5
33 Richmond J 23
3 Rensselaer B 8
6 Rushville K 19
3 Salem M 16
7 Seymour M 18
11 Shelbyville K 17
104 South Bend B 13
5 Sullivan M 6
5 Tell City R 10
63 Terre Haute K 6
5 Tipton H 15
5 Union City H 23
8 Valparaiso C 8
18 Vincennes P 6
9 Wabash E 16
9 Warsaw D 16
9 Washington O 7
5 West Lafayette G 9
4 White Cloud G 9
4 White Oak K 6
11 White River H 21
5 Winchester H 21

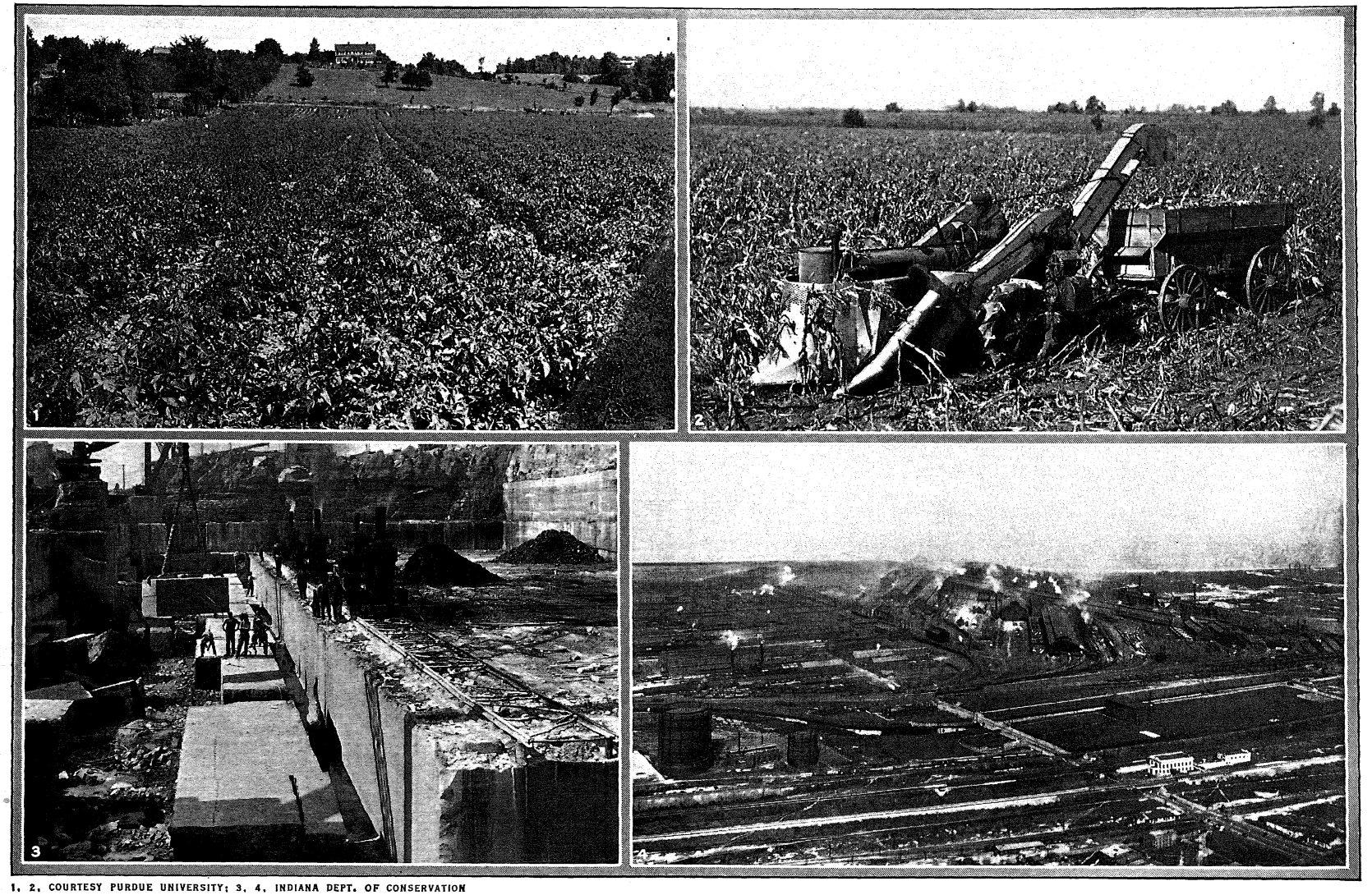

LAKE MICHIGAN
Chicago
Michigan City
Gary
Hammond
East Chicago
Whiting
Indiana Harbor
Hobart
Lake Station
Crown Point
Valparaiso
Joliet
Kankakee
Terre Haute
Fort Wayne
South Bend
Elkhart
Goshen
LaPorte
Michigan City
Plymouth
Rochester
Peru
Logansport
Kokomo
Marion
Muncie
Anderson
Richmond
New Castle
Connersville
Greensburg
Shelbyville
Franklin
Columbus
Seymour
Madison
Jeffersonville
New Albany
Louisville
Bloomington
Bedford
Vincennes
Washington
Princeton
Evansville
Henderson
Owensboro
Tell City
Rockport
Boonville
Huntingdon
Wabash
Warsaw
Auburn
Kendallville
Angola
Hillsdale
Coldwater
Three Rivers
Centerville
Sturgis
White Pigeon
Niles
New Buffalo
Michigan City
Laporte
Valparaiso
Hobart
Gary
Hammond
East Chicago
Whiting
Indiana Harbor
Chicago
West Chicago
Wheaton
Joliet
Kankakee
Watseka
Iroquois
Danville
Champaign
Urbana
Vermilion
Fountain
Montgomery
Parke
Putnam
Clay
Vigo
Clark
Crawford
Sullivan
Greene
Lawrence
Knox
Daviess
Martin
Pike
Dubois
Gibson
Posey
Warrick
Spencer
Perry
Harrison
Crawford
Floyd
Clark
Scott
Jackson
Jennings
Switzerland
Ohio
Dearborn
Ripley
Decatur
Franklin
Union
Fayette
Rush
Henry
Wayne
Randolph
Darke
Preble
Montgomery
Miami
Cass
Fulton
Marshall
Starke
Pulaski
Jasper
Newton
Lake
Porter
La Porte
St. Joseph
Elkhart
Lagrange
Steuben
Noble
Dekalb
Allen
Whitley
Kosciusko
Wabash
Huntington
Wells
Adams
Jay
Blackford
Grant
Howard
Carroll
Tippecanoe
Benton
Warren
White
Jasper
Pulaski
Fulton
Marshall
Kosciusko
Wabash
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Wells
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Allen
Whitley
Noble
Dekalb
Steuben
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Randolph
Darke
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Montgomery
Miami
Cass
Howard
Tipton
Hamilton
Boone
Clinton
Carroll
White
Benton
Warren
Fountain
Parke
Putnam
Hendricks
Morgan
Johnson
Shelby
Rush
Fayette
Union
Wayne
Henry
Delaware
Jay
Blackford
Grant
Madison
Hancock
Hamilton
Boone
Clinton
Tipton
Howard
Carroll
Tippecanoe
Benton
Warren
White
Jasper
Pulaski
Fulton
Marshall
Starke



COURTESY INDIANA DEPT. OF CONSERVATION

SCENIC VIEWS IN INDIANA'S STATE PARKS

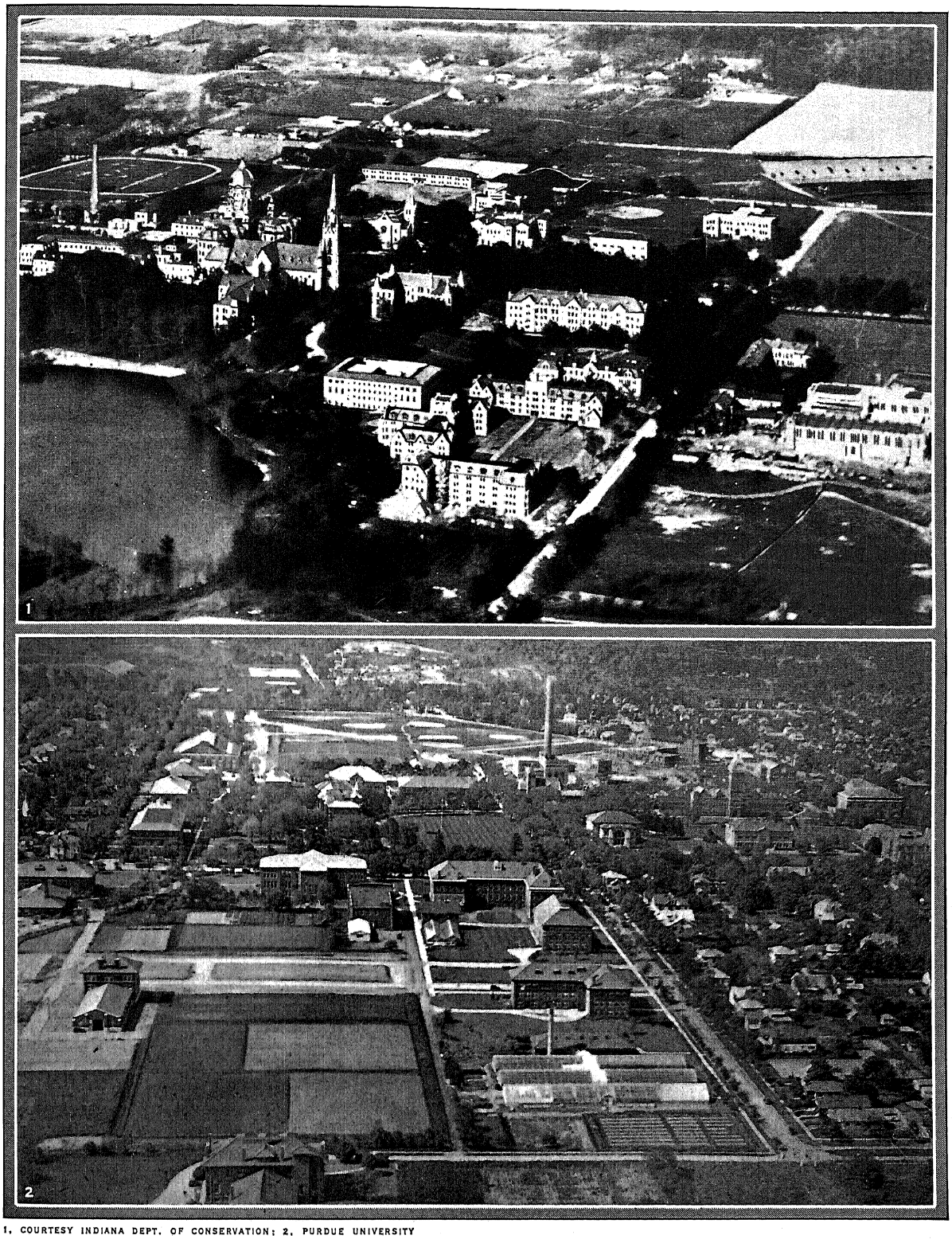
1. Turkey Run Hollow, superb rock scenery in the Turkey Run State Park. 2. Wall bordering McCormick's Creek Canyon. 3. Clifty Falls, Clifty Falls State Park, situated in the Ohio River valley. 4. Scene in Turkey Run State Park.



1, 2, COURTESY PURDUE UNIVERSITY; 3, 4, INDIANA DEPT. OF CONSERVATION

RURAL AND INDUSTRIAL SCENES IN INDIANA

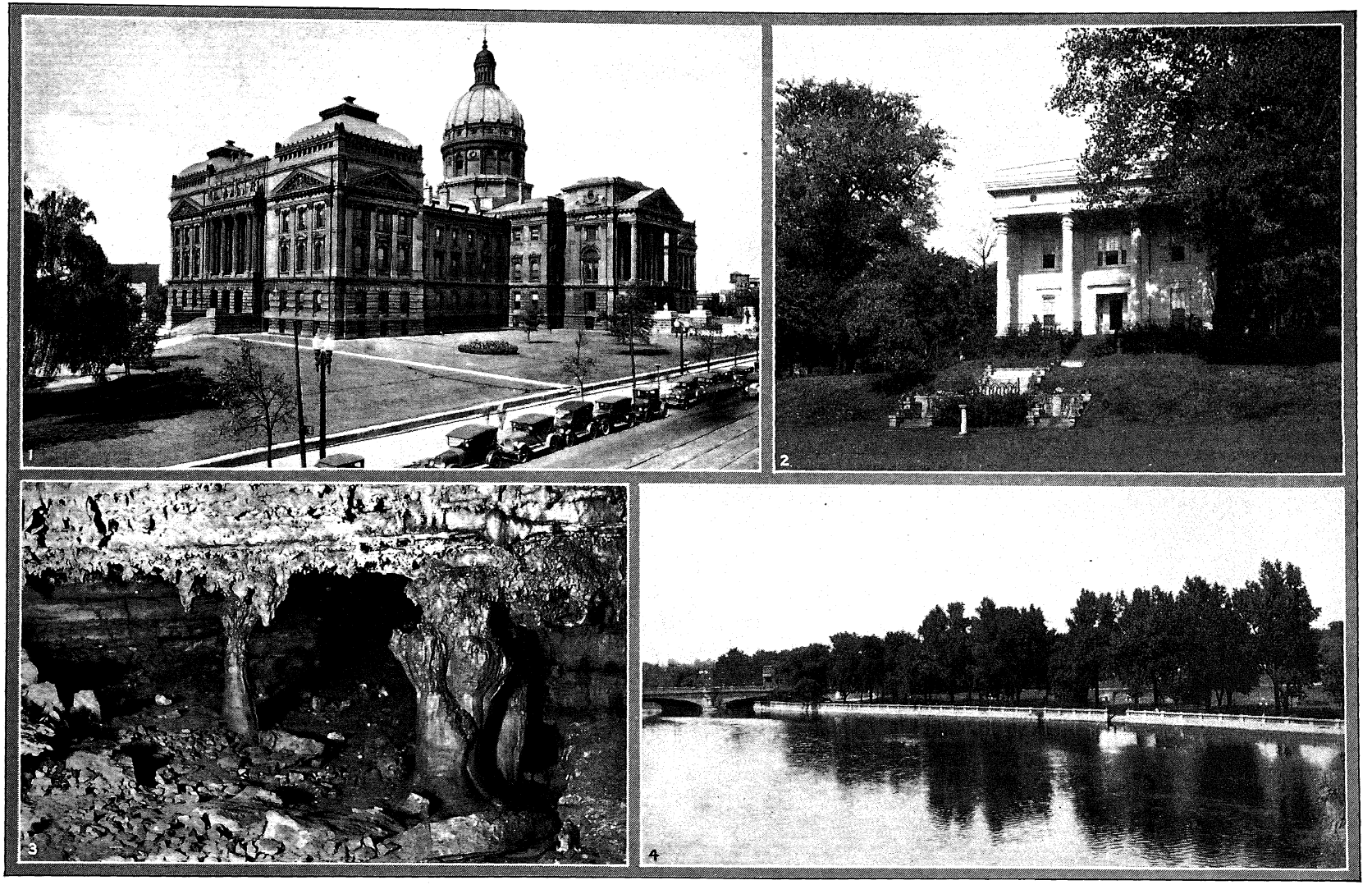
1. Field of the famous Indiana-Baltimore variety of tomato. **2.** An automatic corn-picker in a field near Romney. **3.** Quarry in Bloomington producing oolitic limestone. **4.** Aerial view of the Gary plant of the United States Steel Company.



1, COURTESY INDIANA DEPT. OF CONSERVATION; 2, PURDUE UNIVERSITY

PANORAMAS OF NOTRE DAME AND PURDUE UNIVERSITIES

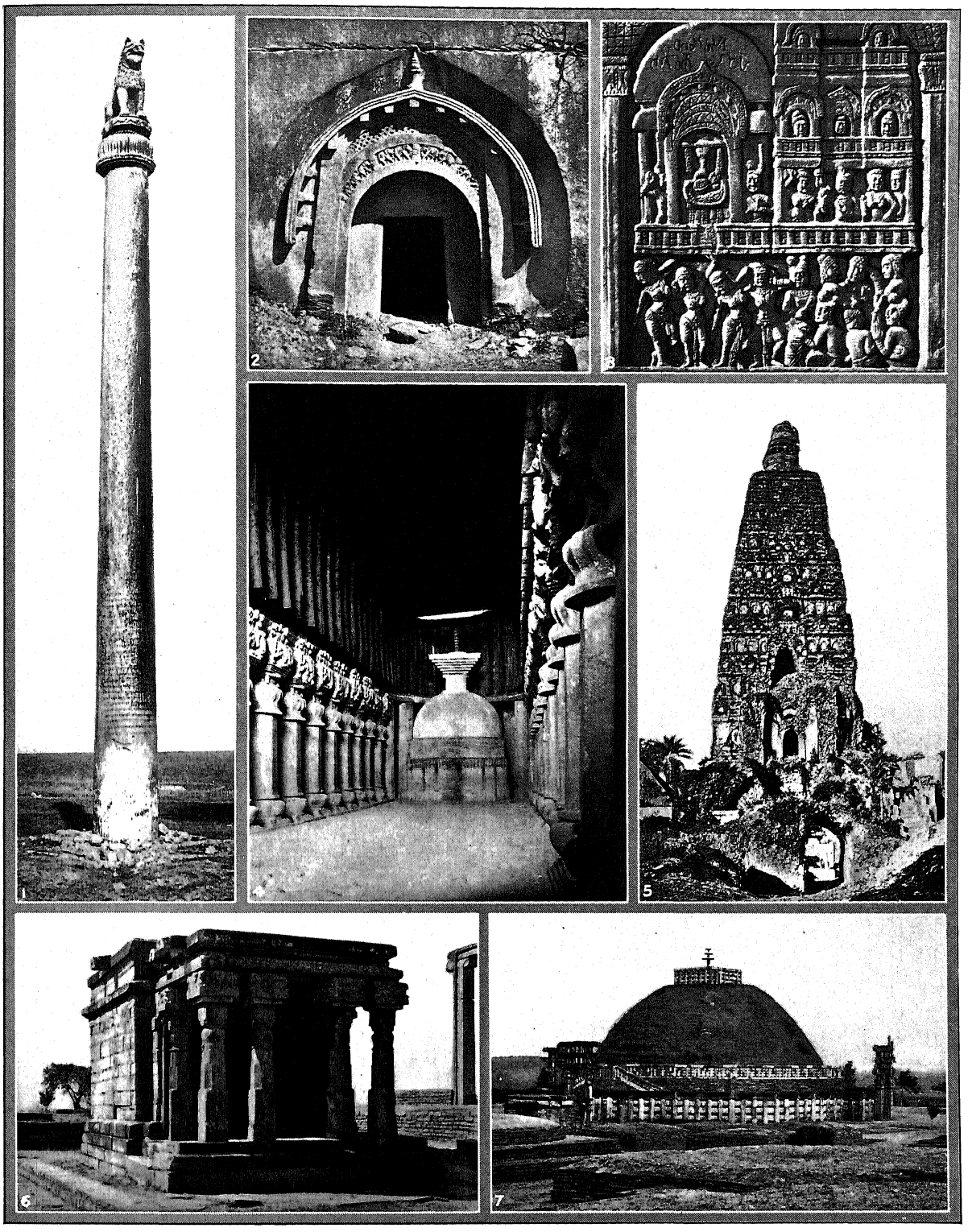
1. Campus of Notre Dame University, South Bend.
2. Campus of Purdue University, Lafayette.



COURTESY INDIANA DEPT. OF CONSERVATION

A VARIETY OF VIEWS IN THE STATE OF INDIANA

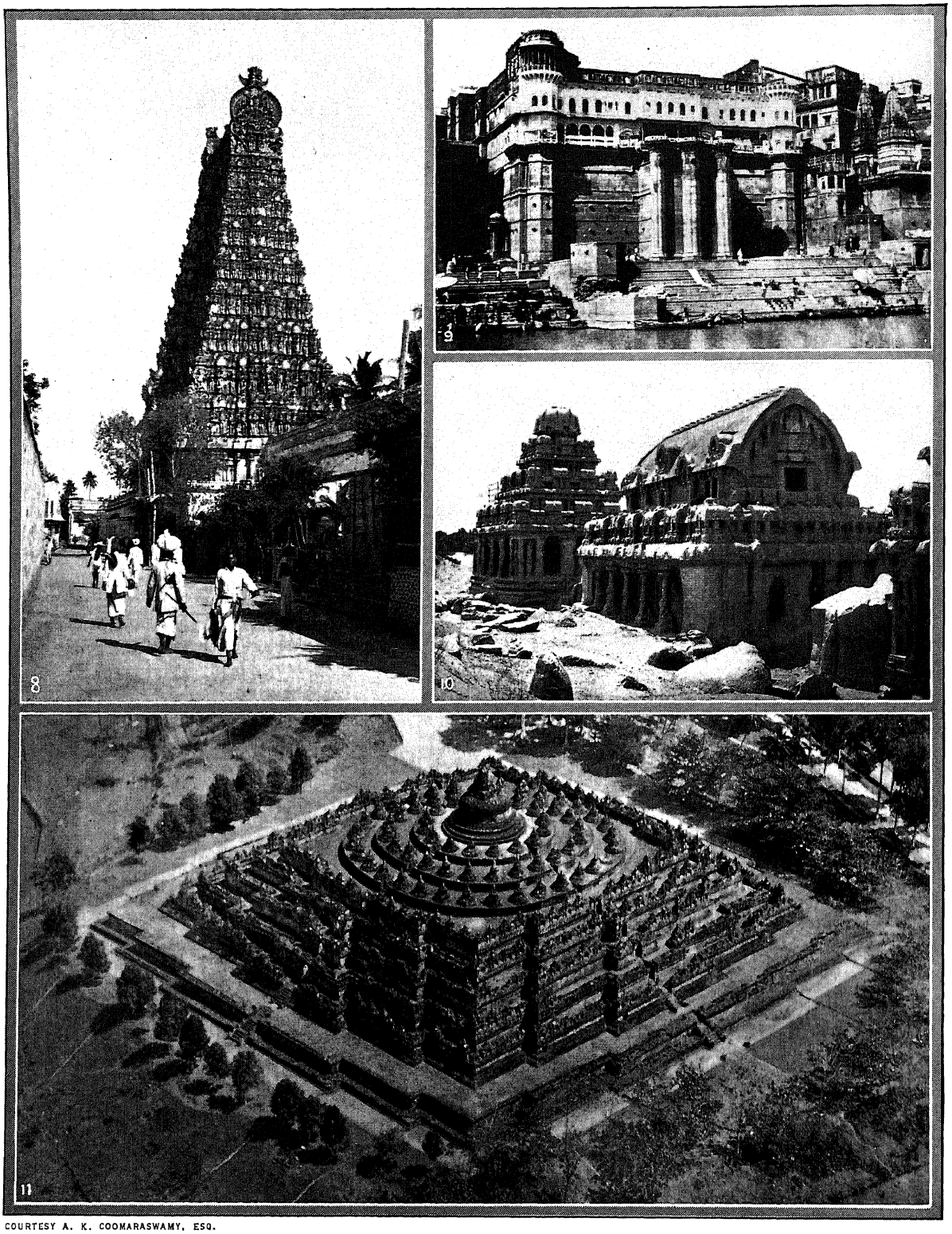
1. The State Capitol at Indianapolis, erected at a cost of $2,000,000. **2.** James F. D. Lanier Home, built in 1842, at Madison. **3.** Wyandotte Cave, in the limestone regions of Crawford County. **4.** Howard Park along the St. Joseph River at South Bend.



COURTESY A. K. COOMARASWAMY, ESQ.

I. MONUMENTS OF INDIAN ARCHITECTURE

1. Asoka pillar at Camparam. 3rd century B.C. **2.** Lomas Rsi "cave," Barabar Hills. 3rd century B.C. **3.** Shrine, and palace (*prasada*), Bharbut. About 175 B.C. **4.** Vajrasana Temple at Bodhgaya. 5th century A.D. or earlier. **5.** *Caitya*-hall at Karli. 1st century A.D. **6.** Temple at Sarnath. 4th-5th centuries A.D. **7.** The great stupa at Sanci.

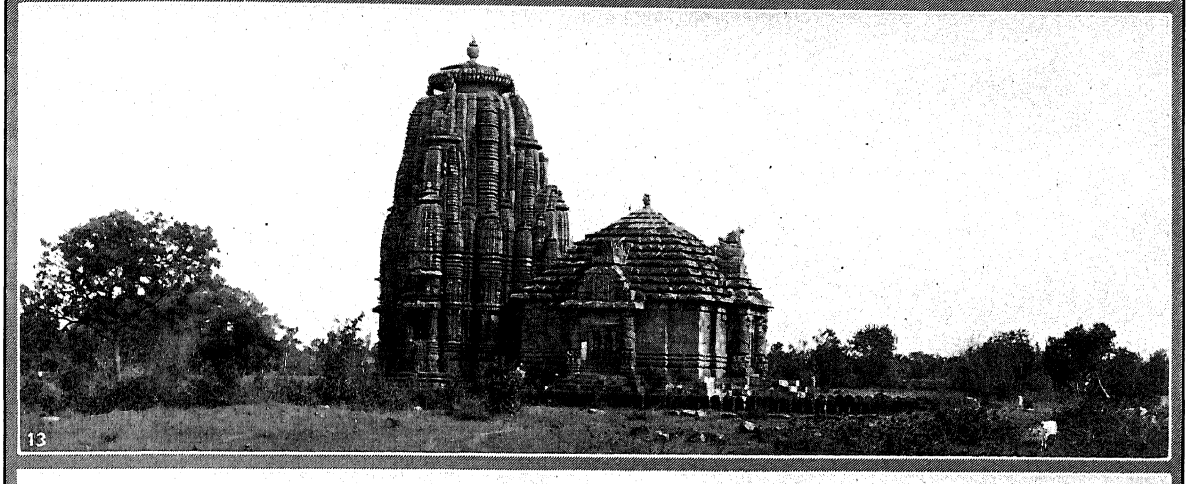


COURTESY A. K. COOMARASWAMY, ESQ.

II. MONUMENTS OF INDIAN ARCHITECTURE

8. *Gopura* of the Minaksi Temple at Madura. 17th century. **9.** Munshi Sri Dhar's Palace at Benares. 19th century. **10.** The Dharmaraja and Bhima *rathas* at Mamallapuram. 7th century. **11.** Borobudur, Java. 8th century.







COURTESY A. K. COOMARASWAMY, ESQ.

III. MONUMENTS OF INDIAN ARCHITECTURE

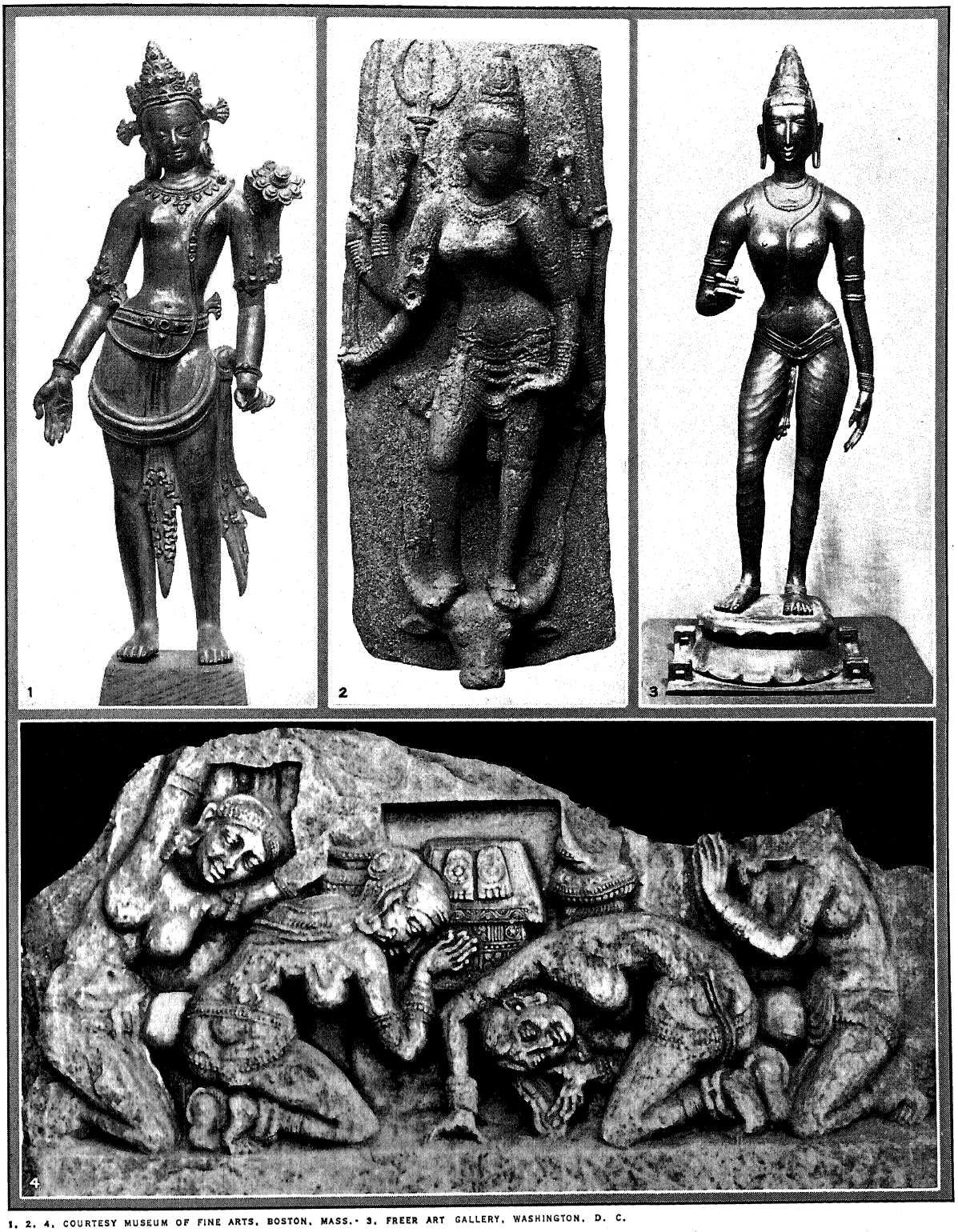
12. Aṅkor Wat, Cambodia. 12th century. **13.** Raj Rani Temple at Bhuvanesvara. 12th century. **14.** Kailāsanātha Temple at Conjeevaram. 8th century.



COURTESY INDIA STATE RAILWAYS

ANCIENT JAIN AND BUDDHIST CAVE TEMPLES OF INDIA

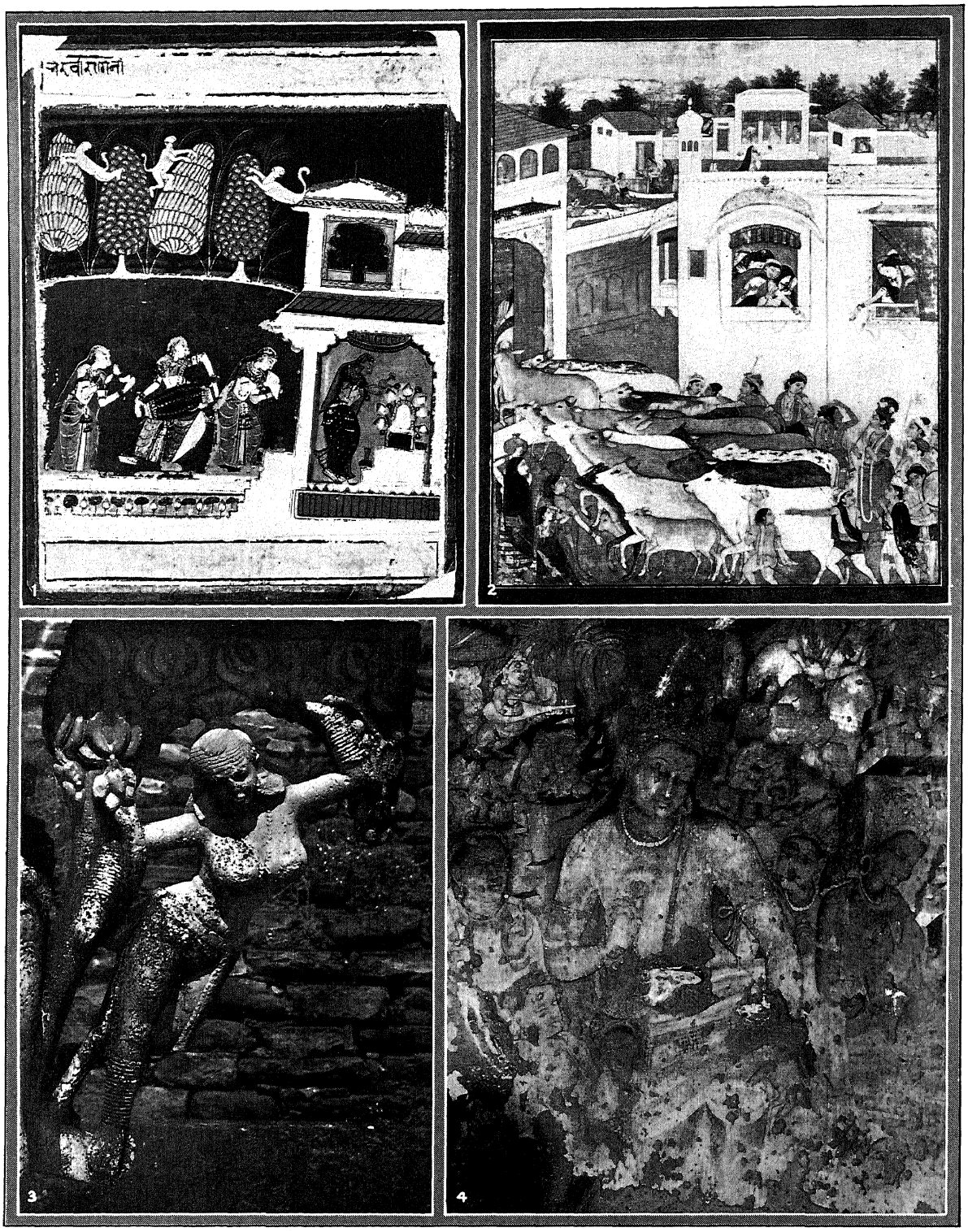
1. Cave XIX, one of the excavated caitya-halls at Ajantā, a Buddhist cave temple hewn out of solid rock. 6th century A.D. **2.** Veranda of the Indra Sabhā Cave at Elūrā, showing the statue of the Hindu deity Indra seated on the elephant Airāvata. 8th century A.D.



1. 2. 4. COURTESY MUSEUM OF FINE ARTS, BOSTON, MASS. · 3. FREER ART GALLERY, WASHINGTON, D. C.

EXAMPLES OF INDIAN SCULPTURE

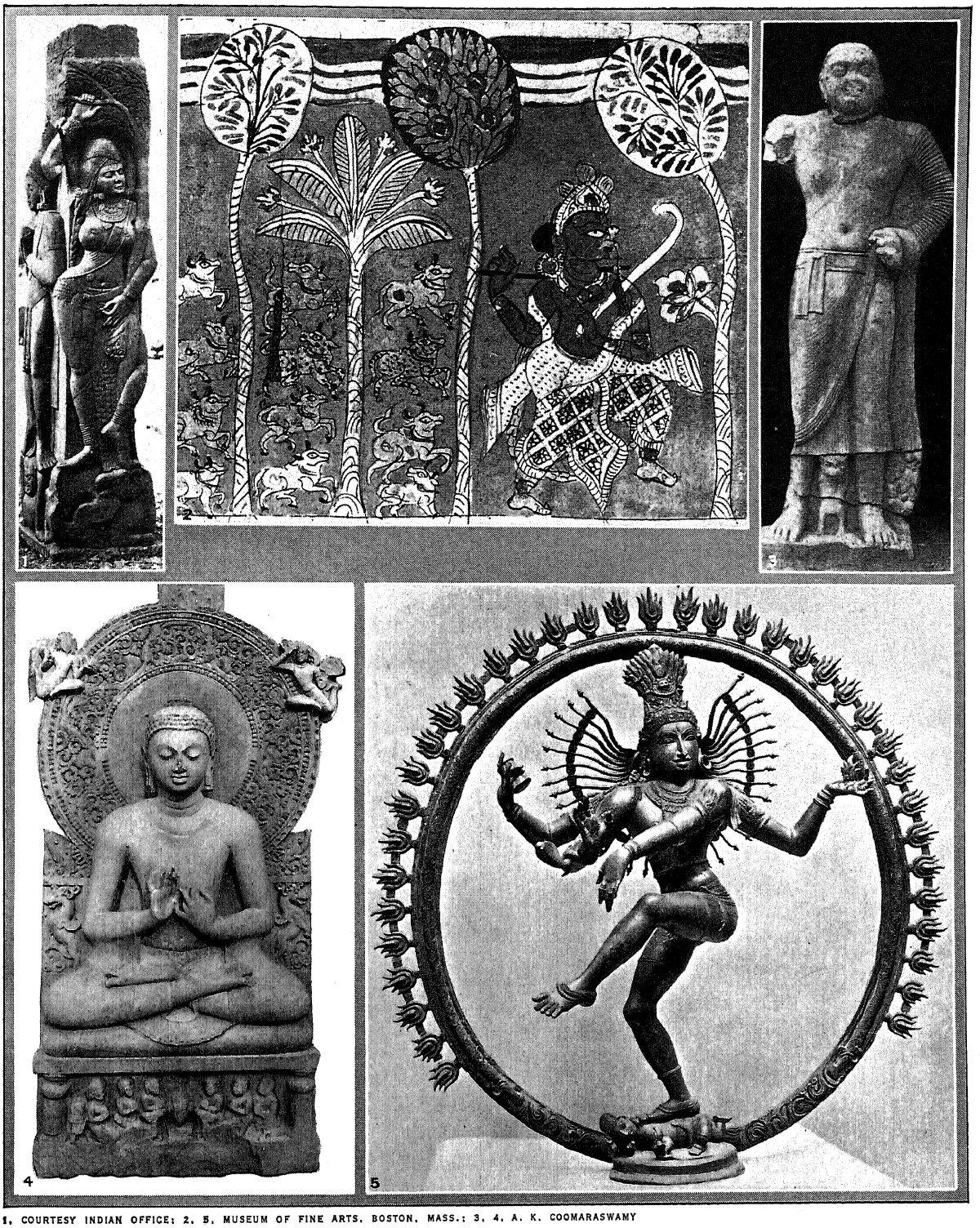
1. The Bodhisattva Avalokiteśvara, of copper from Nepal, 10th-11th centuries. **2.** The Goddess Durgā on the head of Mahisa, southern India, 7th century. **3.** Goddess or deified queen, of copper from southern India, 11th century. **4.** Detail of a relief of worshippers of Buddha, one of the sculptures of Amarāvatī, about 200 B.C.



1, 3, 4, COURTESY ANANDA COOMARASWAMY; 2, MUSEUM OF FINE ARTS, BOSTON, MASS.

INDIAN ART: PAINTING, MURALS AND SCULPTURE

1. Rajput painting, Bhairavī Rāginī, about 1600. 2. Rajput painting, Krishna bringing home the cows at the hour of "Cowdust," 18th century. 3. Yaksī bracket from a gateway (*torana*), at Sāñcī, dating from 100-50 B.C. 4. The Great Bodhisattva, detail of a painting from one of the caves of Ajantā, 7th century.



1, COURTESY INDIAN OFFICE; 2, 5, MUSEUM OF FINE ARTS, BOSTON, MASS.; 3, 4, A. K. COOMARASWAMY

BUDDHIST AND HINDU DEITIES IN INDIAN ART

1. Yakṣa (left) and Yakṣī (full view), Indian deities: a railing pillar of about 150 B.C. of Bhārhut. **2.** Krishna with the herds, from a paper manuscript, a Gujarati painting, 15th century. **3.** Colossal figure of the Bodhisattva (Buddha) from Sārnāth, set up by Friar Bala, 132 A.D. **4.** Seated Buddha from Sārnāth, 5th century A.D. **5.** Śiva as Natarāja, the "dance-king," made of copper from southern India, 18th or 19th century.

was dissolved when Ohio attained statehood; the remainder formed Indiana Territory. Michigan Territory was cut off in 1805 and Illinois Territory in 1809, leaving Indiana with practically the present state boundaries.

Clarksville, founded in 1784, at the falls of the Ohio, was the first American settlement. Immigration awaited the cessation of Indian warfare (*see* OHIO). The defeat at Fallen Timbers quelled the Indians for many years, and the Treaty of Greenville, 1795, began the extinction of the Indian title to Indiana. Immediately settlers sought the region. In 1810 the population of Indiana Territory reached 24,520. The last great Indian uprising in Indiana began in that year (*see* TECUMSEH), and was terminated by Gov. WILLIAM HENRY HARRISON'S victory at Tippecanoe, Nov. 7, 1811. Indian hostilities during the WAR OF 1812 were on a small scale and were promptly suppressed. Immigration was greatly accelerated after the war, a stream from the New England and Middle States entering the northern part of Indiana, counterbalanced by emigration from the southern states into the southern part. A state constitution was adopted on June 29, 1816; statehood was conferred on Nov. 7. The federal census of 1820 revealed an increase of 122,628 persons within the decade. The seat of government was removed from Corydon, which in 1813 had succeeded Vincennes as capital, to Indianapolis in 1825. Until 1857 the single period of depression was that following the panic of 1837. Local politics was seriously disturbed during the CIVIL WAR, when many Southern-born citizens were involved in the KNIGHTS OF THE GOLDEN CIRCLE or other disloyal activities, but Gov. Oliver P. Morton, one of the ablest of the "War Governors," by extraordinary measures protected the interests of the Union. During the next 50 years, while the state was enjoying material prosperity, a remarkable number of political leaders and popular writers was associated with Indiana. In the 1920's the KU KLUX KLAN temporarily controlled the state offices, but its power was broken as the result of a series of political scandals. Gov. MacCray, convicted of fraud, received a prison sentence and fine in 1924; in 1928 Gov. Jackson was tried for conspiracy to bribe, but was acquitted. Usually Republican in politics, in 1932 Indiana gave its 14 electoral votes to Roosevelt. Frederick Van Nuys, Democrat, was elected to the Senate, and Paul V. McNutt, also a Democrat, won the governorship.

BIBLIOGRAPHY.—W. H. Smith, *The History of Indiana,* 1897; Logan Esarey, *A History of Indiana to 1850,* 1915.

INDIANA, a borough in southwestern Pennsylvania, county seat of Indiana Co., and 46 mi. northeast of Pittsburgh. It is served by two railroads. Indiana lies at the foot of the Allegheny Mountains, in the center of a bituminous coal-mining region. It is the shipping center for the district, and has flour and woolen mills and factories producing glass, automobile tires and wood products. Indiana is the seat of Indiana State Teachers College. Pop. 1920, 7,043; 1930, 9,569.

INDIANAPOLIS, the capital and largest city of Indiana, and the county seat of Marion Co., situated in the center of the state on the White River, about 110 mi. northwest of Cincinnati, O. The city is an important railway center, with eight trunk railroads and numerous smaller lines radiating from it. It has also a municipal airport, and several traction, bus and truck lines. The first union railroad station in the United States was built in Indianapolis.

Indianapolis is the largest city of the United States without water transportation. It is well laid out, with broad boulevards and a comprehensive system of parks. Notable features are the lofty Soldiers' and Sailors' monument, surmounted by a figure of Victory, and the $10,000,000 World War Memorial Plaza. The main streets radiate from the park at the base of the monument. The city is also noted for its motor speedway.

Its advantageous situation and transportation facilities make Indianapolis an important wholesale and manufacturing center. It has a large trade in corn and other grains, and large meat-packing plants. In 1929 its manufactures had a total value of approximately $407,000,000 in 1929, with automobiles, railroad cars, furniture, cotton and woolen goods, malleable iron, foundry and machine shop products among the most important items. Its wholesaling organizations, 449 in number, distributed merchandise worth $278,928,925, with livestock and farm products amounting to almost 40% of this total. The 4,920 retail stores, which did an aggregate business of $220,456,834, gave full-time employment to 23,153 people.

Indianapolis is the seat of Butler University, chartered in 1849; the schools of medicine and dentistry of Indiana University, and several other educational institutions; the national headquarters of the American Legion, and the state prison for women. The site of the city was given to the state by Congress in 1816. Indianapolis was laid out in 1821, and the state legislature met here for the first time in 1825. It was chartered as a city in 1847. Pop. 1920, 314,194; 1930, 364,161.

INDIAN ARCHITECTURE (exclusive of Moslem). The cities of the Indus Valley culture at Mohenjo Daro and Harappa, dating back to the 3rd and 4th millenniums B.C., had substantial houses of well-burnt brick, laid in mud or gypsum mortar and with a well-developed drainage system, temples and tanks lined with bitumen. Indian architecture as known to us from the 3rd century B.C. onwards was based on wooden forms, of which the most ancient examples are naturally no longer extant. The greater part of the monumental architecture was religious. As the sacrificial (*yajña*) religion of the Vedas required the construction only of elaborate brick altars and temporary wooden sheds, the temple architecture must have arisen in connection with the devotional (*bhakti*) cults in which service (*pūjā*) was offered to a symbol or image. Styles, however, are never sectarian, but distinctive of a given period or area. Stone was employed earlier in Buddhist than

in Hindu practice, and the earliest monuments were therefore Buddhist, or sometimes Jāina; but this does not imply a specifically Buddhist style. Even the *stūpa* was only a development of the older funeral tumulus.

In the Maurya, Suṅga, Andhra and Kuṣāna periods, 322 B.C.-320 A.D., the conspicuous types are those of the *stūpa* or *dagoba* (Fig. 7), a solid hemispherical mound enshrining relics, surrounded by a circumambulation path and railing and forming a monumental symbol of the Buddha or Mahāvīra; the *caitya*-hall (Fig. 5), the excavated replica of a structural apsidal temple, with a nave and aisles, and *stūpa* in the apse; and the *vihāra,* or monastery, consisting of cells around a central court. The first and last types are also represented abundantly in the Graeco-Buddhist art of Gandhāra in the Kuṣāna period. Another interesting type is that of the hypaethral *bodhighara* (Fig. A), or timbered gallery surrounding a sacred tree and altar, now with a Buddhist significance, but evidently taken over from the Yakṣa cults. Two other important forms are those of the *stambha* or *lāt* (Fig. 1), a monolithic column with an animal or other symbolic capital; and the *toraṇa* or monumental gateway, of which magnificent examples are extant at Sāncī (Fig. 7). In the secular field there were extensive walled and moated cities with fortified gateways (Fig. B). Palaces, mansions and the large structural monasteries were terraced structures (*prāsāda*), with stories of diminishing size, each terrace having chambers and independent pavilions used as living-rooms.

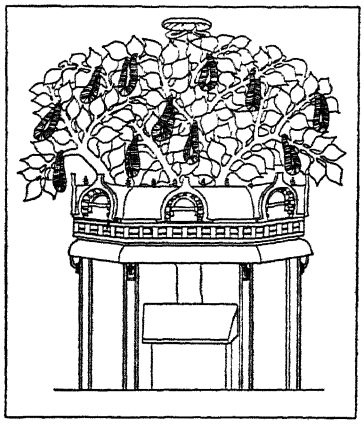


FIG. A. A BODHIGHARA FROM SANCI OF ABOUT THE YEAR 100 B.C.

Gupta, Cāḷuyka, Pallava and Rāṣṭrakūṭas Periods. In the Gupta period, 320-500, or more loosely 650, we find excavated and structural brick and stone temples, Hindu as well as Buddhist. The main types are those of the flat-roofed sanctums with a pillared porch (Fig. 6); and the brick towers, e.g., the tall Buddhist shrine at Bodhgayā (Fig. 4) which is of Gupta or earlier date. A similar shrine is represented on a well-known terra cotta ceiling not later than the 2nd century. Structural apsidal temples survive at Ter, Chezarla and Bādāmī, and this form persists to modern times as a component element of more complex structures.

In the early Cāḷukya, 6th century-753, and Pallava, 6th century-850, periods structural stone temples appear for the first time in southern India. The great Pallava shrines are those of the monolithic *rathas* (Fig. 10), known as the Seven Pagodas, on the shore at *Māmallapuram,* south of Madras; the structural Shore temple at the same place, and the Kailāsanātha (Fig. 14) and other structural temples at Conjeevaram, the Pallava capital. These *vimānas* are pyramidal structures of two or more stories, of the prāsāda type. There are also shrines excavated in solid rock. At or near the Cāḷukya capital of Bādāmī we find a mixture of southern and northern syles. Pallava influence is seen already in the beautiful Mālegitti Śivālaya, about 625, and later in the great Virūpāksa temple, about 740, modeled after the Kailāsanātha at Conjeevaram, and partly built by eastern craftsmen imported by Vikramāditya who had recently captured the Pallava capital. Other early Cāḷukya shrines were provided with simple forms of the northern tower, *śikhara.* Excavated Buddhist temples are found at Aurangābād, and at Ajantā a whole series of *caitya*-halls and monasteries, famous for the paintings preserved on their walls, ranging from the 2nd to the 7th centuries.

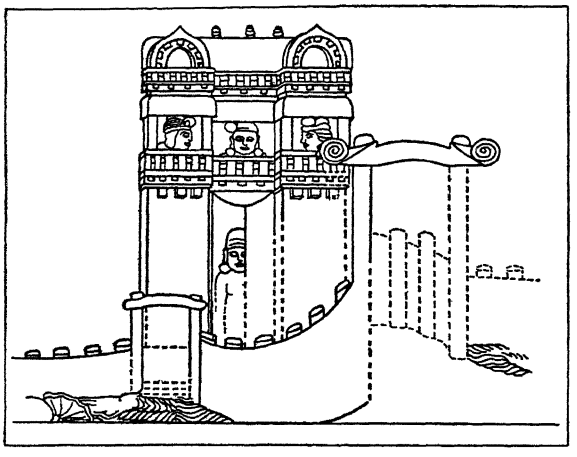


FIG. B. A CITY GATE (DVARA-KOSTAKA) FROM SANCI OF ABOUT THE YEAR 100 B.C.

The Rāṣṭrakūṭas, 753-973, succeeded the early Cāḷukyas in the west, and in part the Pallavas in the east. Of the large series of excavated shrines at Elūrā dating from the Gupta period onwards, the most famous is the monolithic Kailāsanātha, 8th century, closely related in form to the Virūpākṣa at Hādāmā, and marking the northward extension of the Dravidian (Pallava) style. Closely related are the Das Avatāra, Rāvaṇa kā Khai and Indra Sabhā shrines at the same site. The well-known Brahmanical cave temples at Elephanta are of the same period.

Nāgara, Vesara and Drāviḍa Periods. In the later medieval period the Indian classification of three

styles is useful. These are the Nāgara (northern, also known as Indo-Aryan or Aryavarta); Vesara Dekkhan and Mysore; and Drāviḍa (Dekkhan, far south, and Ceylon). The Nāgara style (Fig. 13, Plate III) is easily recognized by its tall spires built up of compressed reduplicated roofing elements, with predominant vertical lines, curved in towards the top, which is crowned by a large ribbed stone called an *āmalaka*. The Vesara is recognized by its comparatively low elevation, star-shaped plans, straight-edged pyramidal towers and other special features. The Drāviḍa is typified by terraced pyramidal towers, likewise built up of repeated roofing elements, but less compressed, so that horizontal lines predominate, while the crowning motif is a domed, barrel vaulted, or apsidal, construction, never an *āmalaka*. In the later phase the immense temple gateway (*gopura*) far more conspicuous than the main shrine is found.

The Nāgara style is exemplified in the architecture of Oṛissā, 8th-13th century, that of the Pāla school in Bengal, 8th-end of 12th century, and that of Central India and Rajputāna, mainly 8th-12th century but still surviving, and that of the Punjab Himalayas. The development of the style, already recognizable at Bādāmī, can be traced in Oṛissā at Bhuvanesvara, Puri and Koṇārak, showing increasing height and elaboration of the tower. The most important temples are the Parasurāmeśvara, about 750; Rāj Rani (Fig. 13) and Jagannātha (Juggernaut) at Puri, about 1150; Liṅgarāja, tower about 1000 and *maṇḍapa* about 1250, and the Sun temple at Koṇārak (Black Pagoda), 13th century. In Central India the most important groups are those of the Candel capital of Khajurāho, ca. 1000 A.D., and of Mārkaṇḍ in the Nāgpur District. In Rajputāna, the Siddheśvara at Nemawār in Indore State is remarkable both for its perfection and its state of preservation; but examples are too numerous to list. In the Punjab hills (Kuḷū, Kāṅgṛā and Cambā), there are important examples, of which the monolithic temple at Mastūr, Kāṅgṛā, and the temples at Baijnāth and Bājauṛā, near and in Kuḷū, are the most interesting. Kashmir has a local school of its own, characterized by a double pyramidal roof, lantern ceilings, triangular pediments with trefoil niches, and by colonnaded peristyles. The most famous temple is that of Mārtaṇḍ, dedicated to the sun.

The Vesara architecture includes the later Cāḷukya or Solaṅkī style of the Dekkhan, Gujarāt, and parts of Rajputāna, 973-12th century, and the Hoyśala building of the Dekkhan and especially Mysore, about 1111-1310. Both phases are characterized by extreme decorative elaboration. Deservedly famous are the Jaina temples at Mt. Ābū, 1032-1232, built of translucent marble, deeply undercut, so that parts of the decoration are more like lace than stone. Notable too are the great groups of shrines in the Jaina pilgrimage cities of Girnār and Satruñjaya. The great shrine at Somnāth in Kāttaiāwār was wrecked by Mahmud of Ghazna in 1024. In Mysore the unfinished shrine at Halebid, the Keśavatemple at Somnāthpur, 1268, and shrines at Belūr, Ittagi and elsewhere, are of the utmost magnificence. At Śravaṇa Belgoḷa in the Hāsan District, the chief seat of the Jains in the south, there are many temples ranging from the time of the Gangā kings into the Hoyśala period. The distinctive type is that of the *beṭṭa*, a courtyard open to the sky, with cloisters, surrounding a central image not enclosed in a shrine.

The Drāviḍa architecture, Coḷa, 850-110; Vijayanagar, 1350-1600, and Madura, was a further development of the Pallava types, characterized first by an immense development of the central tower, as for example at Tanjore, and later by that of the still more extraordinary growth of the temple gateways, or *gopura* (Fig. 8), to form veritable skyscrapers, dominant features of the southern cathedral cities, such as Madura. The architectural decoration was excessively rich, a sort of Indian Baroque. The style is still current.

The finest surviving examples of secular architecture are to be met with in Rajput palaces of the 16th-19th centuries, at Gwālior, Jodhpur, Udaipur, Datiā, Jaipur, and along the *ghāṭs* at Benares (Fig. 9). Modern Indian city architecture is for the most part a meaningless hybrid or simply a poor imitation of European; but a living tradition is still present in the provinces.

Influences of Indian Architecture. Architecture of Indian origin, but developed on local national lines, is widely distributed in Farther India: Burma, Siam, Cambodia and Annam; and Indonesia: Sumatra, Java and Bali. In general, there was an early period in which the Indian sources were most conspicuous, then a fully evolved classical style, then either a disappearance of the style or its effective reduction to a folk style. In Burma the great building age, illustrated at Paga, was from the 11th-13th centuries. In Siam there was a period of Khmer domination in the 11th and 12th centuries, and Siamese art properly so called began only at the end of the 13th century. In Cambodia, after a Khmer primitif period, 5th-7th centuries, related to Indian Gupta, and characterized by isolated brick towers, there was a classical style, 9th-12th century, of which the most remarkable monuments are the city of Angkor Thom and the temple Angkor Wāt (Fig. 12), a masterpiece of spacious design, consisting of a central massif with five towers, within a walled and moated park, and the Bayon temple, rendered impressive by its great towers bearing masks of the Buddhist divinity Lokesvara. The Bayon style, which includes many buildings and the walls and gates of the city, represents the last and most lavish, though not the purest, Khmer style.

In Java the temples of the Dieng plateau are comparatively simple. Rather more ornate, and very elegant, is the Kalasan shrine, 778, and Caṇḍi Mendut, 8th century. The most important monument is the famous Borobudūr (Fig. 11), about 800. Here an entire hill was mantled by terraced stonework, forming a pyramid of sculptured galleries below, and grouped stupas above. There are remarkable Brahmanical temples of about 900 at Prambanan, in the

same middle Javanese style. After this the development, in which the indigenous factors become more and more evident, continued in eastern Java to the 14th century, and in Bali to the present day. *See also* MOHAMMEDAN ARCHITECTURE. A. K. C.

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INDIAN ART. The serious study of Indian art was neglected until the early part of the present century. It now has an established place in university studies and museum collections, and there is an extensive literature on the subject. The recent discovery of remains of cities of the third and fourth millennia B.C. (Indus Valley culture) at Mohenjo Daro and Harappa, with architecture, sculpture, seals, metal-work and painted pottery with Sumerian affinities, has greatly stimulated interest in Indian pre-history. The greater part, however, of the architecture, sculpture, painting and minor arts extant *in situ* or in museums dates from the third century B.C. (Maurya period) onward. The sculptural record is the most continuous, and exhibits a typical cycle from powerful "primitives" through a classical (Gupta period, 4th-5th century A.D.) and later medieval and rococo developments to the present day. The architectural record is particularly rich after the fifth century A.D. The practise of painting was continuous, but apart from the early frescoes of Ajanta and Bagh (2nd-5th centuries) little is preserved before the Begali, Nepalese and Gujarati manuscripts of the 11th to 16th centuries, after which come the numerous Rajput and Mughal paintings of the late 16th to 19th centuries. Recently there has been a revival of painting in Bengal; with this exception the arts have survived only in the provinces, where European influence has not been too strongly felt.

Indian art is almost entirely a professional product, mainly religious in theme, and therefore of a markedly hieratic character. The sculptor is guided by canons of proportion (*pramana*) and by prescriptions for divine types, collectively constituting the technical books known as Silpa Sastras, some of which date back to or before the Gupta period. The narrative sculpture, effigies of individuals, and the painting are naturally somewhat less formal, but the art as a whole is markedly idealistic and cerebral. In great periods it is marked by powerful expression and deep feeling. All of the art has practical *raisons d'être* and is closely related to the literature and drama. A theory of beauty (*rasa*) refers esthetic experience primarily to the activity of the spectator. Closely related developments took place in Ceylon and throughout Farther India (Burma, Siam, Malay Peninsula, Cambodia, Annam) and Indonesia (Sumatra, Java, Bali), the most important remains in architecture and sculpture falling between the 5th and 13th centuries. Mohammedan art in India, viz., architecture from the 13th century onward, painting and minor arts in the Mughal period, c. 1660-1860, attained a high development; the most famous monuments are the tombs in the neighborhood of Delhi and at Bijapur, the TAJ MAHAL at Agra, and the palaces at Agra and Fatehpur Sikri.

Chief collections: in India, museums of Calcutta, Madras, Mathura (Muttra), Lahore; in Europe, London, Berlin, Paris; in the United States, Boston, New York, and Washington (Freer Gallery). Chief sites in India easily accessible: Elephanta, Elura, Ajanta, Sanci, Mt. Abu, Delhi, Agra, Sarnath (Benares), Bhuvanesvara, Mamallapuram ("Seven Pagodas"), Madura; in Ceylon, Anuradhapura; in Burma, Pagan; in Siam, Ayuthia; in Cambodia, Angkor; in Java, Borobudur and Brambanan. A. K. C.

INDIANA UNIVERSITY, at Bloomington, Ind., a coeducational state institution founded in 1820 as a state seminary. In 1827 the name was changed to Indiana College, and in 1838 the college was raised to the rank of a university. It was officially recognized as the state university in 1852. The university comprises a College of Arts and Sciences, schools of Commerce and Finance, Education, Law and Music, all in Bloomington; and schools of Medicine, Dentistry and Nursing, in Indianapolis. The productive funds in 1931 were $1,776,135. The library of 233,000 volumes contains special collections on international law, mathematics, Greek, Latin, English and French literature. In 1931-32 there were 4,650 students, with a faculty of 316 headed by Pres. WILLIAM LOWE BRYAN.

INDIAN CLUBS, solid wooden bottle shaped clubs, swung by the hands to provide gymnastic exercise for the arms and chest. Such clubs are now included in the regular equipment of all gymnasiums. Before exercising with Indian clubs the student usually loosens his arm and chest muscles with the simpler DUMB-BELL drill. The uneven distribution of weight in the Indian club, which weighs upward of three pounds, demands a certain skill in swinging it in small or large circles, and unless supervision is at hand the beginner may easily overstrain his body. After proficiency in small and large side swings has been attained with one club, the student may undertake to learn the more complicated exercises with two. A common exercise with two Indian clubs combines a large front swing, ending with a smaller swing behind the head within the arc circumscribed by the front swing. As one arm executes the small circle, the other begins the large front swing. To avoid striking the clubs, the student must develop a sense of timing. *See also* PHYSICAL TRAINING.

INDIAN CORN, an early name for the important cereal known also as MAIZE, but in the United States generally called CORN.

INDIAN CUCUMBER-ROOT (*Medeola virginiana*), a perennial herb of the lily family, frequent in woodlands in eastern North America. The slender, unbranched stem, about 2 ft. high, rising from a white fleshy rootstock, bears two whorls of leaves. Protected by the upper whorl is a cluster of small,

greenish-yellow, nodding flowers which are followed by purple berries. The rootstock, which tastes and smells like cucumber, was used for food by the Iroquois and other Indians.

INDIAN DRAMA. The beginnings of Indian drama are shrouded in the mists of antiquity. Certainly India is the ancient home of song and dance and festival. It is possible that a well-developed Indian drama existed in the pre-Christian era, paralleling or antedating the Greek. But no specimen of such a drama is extant. There is even much speculation as to the dates of the plays which have survived, although these are known to have been composed between the 2nd and the 11th centuries.

To-day about 25 plays of the so-called classic period are available. The earliest group, 13 in all, are attributed to Bhāsa, but these are inferior to the three plays of Kālidāsa, whose *Shakuntalā* is the masterpiece of Indian dramatic literature. He is thought to have lived in the 5th century. Next to the *Shakuntalā* in importance is *The Toy Cart,* sometimes attributed to King Shūdraka, though of uncertain authorship. Both these latter plays exist in excellent English translations, the first English version of the *Shakuntalā* having been made in 1789 by Sir William Jones.

These Indian plays are notable for their graceful blending of poetry and prose, for their life-like characterizations and sophisticated gentility. In contrast to the early Greek dramas (*see* GREEK DRAMA), they abhor violence, and end always upon a note of happiness. They were written for presentation before aristocratic audiences, and were composed chiefly in Sanskrit, the classical language of India. Both sexes participated in the performances. The themes of the plays were drawn largely from epic poetry, and frequently centered in the legends of Rāma and Krishna, the two most celebrated incarnations of Vishnu.

During the 19th century the Indian theater felt the influence of European civilization, and as a consequence, an effort was made to compose plays of modern life. This effort, however, did not produce any remarkable results. At the present time the tendency, as exemplified in the work of RABINDRANATH TAGORE, is to create a drama which will combine the classic beauty and spiritual purity of ancient India with modern social ideals. G. HU.

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INDIAN LITERATURE, for a full treatment of the literature of India, consult the article SANSKRIT LITERATURE.

INDIAN OCEAN, a large body of water bordered by Africa on the west, and the Malay Peninsula, Sumatra, Java and Australia on the east. It is bounded on the north by the Arabian Sea and Bay of Bengal, arms of the ocean indenting the coast of India; and is separated on the south from the Antarctic Ocean by a line joining the southern extremities of Cape Agulhas and Cape Leeuwin. The area of its surface is estimated at 24,000,000 sq. mi. Its average depth is 13,000 ft. and its greatest depth 22,970 ft. The continental islands of Madagascar and Ceylon lie near its outer edge.

The submarine relief of the Indian Ocean is similar to that of the Atlantic in that it has a central rise in its floor, culminating in islands. The Maldive, Chagos and Cocos groups are coral formations, and Mauritius, Crozet and St. Paul's are volcanic. The continental shelf or grade, between the shore and a depth of 100 fathoms, is narrow except in the region of the East Indian islands, and there are "deeps" just outside this shelf. The chief tributary streams are the great Zambesi of South Africa, the Ganges through the Bay of Bengal and the Indus through the Arabian Sea. The latter body of water has two arms, the Persian Gulf which receives the Tigris and Euphrates, and the Red Sea which is connected with the Mediterranean by the Suez Canal.

The Indian Ocean lies entirely below the Equator and principally within the tropics. Its waters are warmer and saltier, and its winds and weather more regular and peaceful than those in either the Atlantic or Pacific. A special feature is the Indian monsoon, which is an important source of moisture for India.



P. A. RYDBERG "FLORA OF PRAIRIES AND PLAINS"

INDIAN PAINTBRUSH
Castilleja sessiliflora

INDIAN PAINTBRUSH, the common name for a numerous genus (*Castilleja*) of herbs of the fig-wort family parasitic on the roots of other plants, many of which bear showy flowers surrounded by highly colored floral leaves. There are about 50 species mostly natives of the new world, some 35 of which occur in North America chiefly from the Rocky Mountains westward. The brilliantly colored floral bracts are often larger than the bright red, yellow or white flowers. Wyoming has adopted a narrow-leaved species (*C. linariæfolia*) as the state flower.

INDIAN PHILOSOPHY, a general designation covering a variety of philosophic systems and ideas spread through a voluminous Sanskrit and Indian vernacular and, recently, English literature, agreeing on certain fundamentals and dating from centuries before the Christian era. Strictly speaking philosophy, meaning well-formulated coherent thought cast in a special terminology, appeared in India with the oldest Upanishads belonging to the earliest prose compositions of the Aryan peoples. Before that, we have, even in the Mantras of the Vedas, a view of life which may yet be considered philosophical because it defines symbolically, that is, in terms not different from language denotations for concrete objects—man's place in the world of meaningful relations. During

and following the nascent Upanishadic epoch there was a period of mental ferment in which philosophic thought moved towards clarification and definitiveness. These developments are traceable, for example, in the *Mahābhārata,* an epic containing several philosophic sections, including the Bhagavad Gītā, and in the Jain and Buddhist philosophic literature that sprang up from the teachings of Mahāvīra and Gotama Buddha in the 6th and 5th centuries B.C. In addition, essential philosophic tenets were formulated for mnemonic purposes in aphorisms (*sūtras*) which tradition ascribes also to certain individuals. Extremely terse, these *sūtras* occasioned the rise of famous commentators in post Christian centuries who, synthesizing the labors of earlier scholiasts, standardized the interpretation of the systems thus created. Because they held that all types of reflective thinking are illustrated by these systems, Indian philosophers since then have rested content with studying and expounding them to suit novel conditions. Contact with Western ideas is once more leading to reformulations.

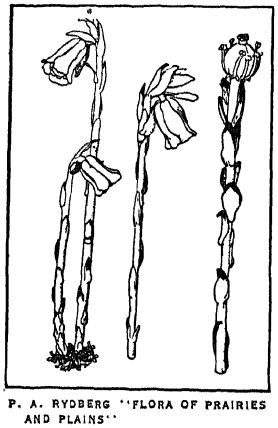
Differing from Western philosophy and yet based on an outlook on life commensurate with reason and experience, all Indian philosophy is motivated primarily by a search for a way of life at once consistent with the nature of reality and conducive to *mokṣa,* that is, freedom from sorrow and suffering as the most pervasive aspects of life. Thus, Indian philosophy is ethically oriented. Though not intrinsically theological, nor eschatological, it is open to religious interpretation, as *mokṣa* is believed coincident with a state of being which we generally mean when speaking of God. In admitting the possibility of experiencing its ultimate findings by one properly trained in physical, mental, moral, and spiritual discipline (*yoga*), it may be styled mystical. It is speculative in transcending common sense and everyday experience, and intellectual in analyzing and synthesizing the knowledge content as part of its method. Being strictly logical in annunciating regularly at the outset the sources of knowledge (*pra mānas*) conceded, it is distinct from *lokāyata,* i.e., popular, non-philosophically achieved unity in diversity. While all systems are unanimous in acknowledging *karman* (the recoil of good and evil thought and action) as determining life's circumstances for the individual entity in the round of rebirth (*samsāra*), each is sharply defined by its theory of the nature of the world and the human mind (*manas*) and self (*ātman*) as necessary conditions for *mokṣa.* Still, they may be classed under three fundamental types of points of view (*darśanas*) aiming at reality or truth, the oneness of which no Hindu thinker doubts:

1. Pluralism, recognizing the objective existence, independent of the knower, of elementary substances and energies constituting the mental and physical world of experience. The Nyāya, a system of logic and discourse, the Vaiśesika, an analysis of the physical universe, and Jain philosophic thinking belong here. 2. Dualism, affirming the existence, independent of the knower, of only one ultimate substance or energy as underlying the knower's psycho-physical experience. Principal representatives are the Sānkhya, essentially a psychology, and the Yoga, a practical method of realizing philosophic truths. 3. Monism, which views the whole of the objective universe, physical and mental, as originating from and depending entirely on the experiencing subject as the only real being, in the sense of never undergoing change nor suffering limitation in space. The chief systems are the Vedānta, an idealistic metaphysics and epistemology, which terms the ultimate reality *brahman,* equating it with *ātman,* and the ethical philosophy of the Buddha which calls it *nirvāna.*

Philosophic thinking is natural to the Hindu mind. Social and belletristic literature and religions as Tantrikism and Shivaism, for example, are saturated with philosophic ideas. Vedantic elements are particularly pronounced. Though unique and national, Indian philosophy, in virtue of its presuppositions, readily assimilates foreign thought. It has been valued by men like Emerson and Schopenhauer. Its influence on the West is constantly increasing. K. F. L.

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INDIAN PIPE (*Monotropa uniflora*), a small parasitic or saprophytic plant of the heath family, called also corpse plant. It is found in rich dark woods almost throughout North America and also in Asia. The smooth, fleshy, often clustered stems, which are usually waxy-white, but sometimes pinkish or dark red, turn black upon drying. They grow 4 to 10 in. high, bearing scaly bracts in place of leaves and a single, bell-shaped, nodding flower, which becomes erect in fruit. In appearance the plant somewhat resembles a white clay tobacco pipe, hence the name.



P. A. RYDBERG "FLORA OF PRAIRIES AND PLAINS"

INDIAN PIPE

INDIAN SUMMER, that part of the autumn season, especially in the northeastern part of the United States, when the air is dry, hazy and calm, and the weather warm and balmy. It usually lasts several weeks and is often preceded and followed by cold, rainy or frosty weather, the period preceding it being known as squaw winter.

INDIANS, AMERICAN, the name given to the natives of America by Columbus, who believed he had reached the East Indies. Unlike the Andean Indians of South America, the Indians of the United States and Canada had not attained a high level of civilization; for the most part they had few domestic arts beyond pottery making and weaving, and they had domesti-

cated only the dog. Tribal customs differed widely, and the languages spoken derived from over 50 linguistic stocks. Administration of the tribe was generally entrusted to a chief, called the sachem, who had a



FROM MAXIMILIAN VON WIED-NEUWIED'S ATLAS

MANDAN CHIEF IN STATE DRESS
After a drawing by Karl Bodmer

group of advisers. The Indians believed in immortality and in spirits ruling throughout every manifestation of nature. Agriculture was fairly well developed in many regions, the principal crops being corn, potatoes and tobacco. Buffalo, deer, caribou and, in some localities, fish constituted the leading animal foods.

INDIAN POPULATION, UNITED STATES

State	1910	1920	1930*	Indian Lands Acres
Arizona	39,216	32,989	43,726	18,653,014
California	16,369	17,360	19,212	517,118
Colorado	841	1,383	1,395	468,874
Florida	446	518	587	23,542
Idaho	3,791	3,098	3,638	682,939
Iowa	369	529	660	3,251
Kansas	1,309	2,276	2,454	272,519
Michigan	7,520	5,614	7,080	153,418
Minnesota	10,711	8,761	11,077	1,508,553
Montana	10,814	10,956	14,798	6,053,673
Nebraska	3,809	2,088	3,256	359,542
Nevada	5,246	4,907	4,871	740,635
New Mexico	20,909	19,512	28,941	4,697,224
New York	5,436	5,503	6,973	87,677
North Carolina	2,015	11,824	16,579	63,211
North Dakota	8,253	6,254	8,337	2,105,320
Oklahoma	117,247	57,337	92,725	19,551,890
Oregon	6,403	4,590	4,776	1,718,006
South Dakota	20,352	16,384	21,833	6,685,734
Utah	1,307	2,711	2,869	1,641,307
Washington	10,997	9,061	11,253	2,718,886
Wisconsin	11,428	9,611	11,548	590,111
Wyoming	1,692	1,343	1,845	2,102,286
Other States	1,433	8,510	11,266	91,270
Total	307,913	244,437	332,397	71,398,730

*Includes all persons of mixed white and Indian blood not regarded as white.

The majority of the Indian tribes lived in wigwams or rude huts, but the Pueblos of the southwestern part of the United States built stone dwellings in cliffs as a protection against other tribes. The Eskimos sup-



FROM MAXIMILIAN VON WIED-NEUWIED'S ATLAS

WARRIORS OF THE SAUK AND FOX TRIBE
From a drawing by Karl Bodmer

ported themselves almost exclusively by hunting and fishing, and used dogs to draw their sledges. To practically all the Indians of the North American continent,



COURTESY AMER. MUS. OF NATL. HISTORY

DUGOUT CANOE OF THE KWAKIUTL INDIANS OF BRITISH COLUMBIA
From a model by Ned J. Burns

the use of metal was undeveloped, domestic utensils being made of stone, pottery, wood, bark and animal skins.

See also separate articles on: APACHE; BLACKFOOT; CAYUGA; CHEROKEE; CHEYENNE; CHIPEWYAN; CROW; DAKOTA; DELAWARE; ESKIMO; HOPI; IROQUOIS; KICKAPOO; MOHAWK; NAVAHO; NORTH AMERICAN INDIANS, LANGUAGES OF; OMAHA; ONONDAGA; ONEIDA; OTTAWA; PAWNEE; POTAWATOMI; SANTEE; SAUK AND FOX; SENECA; SHAWNEE; SIOUAN; TUSCARORA; UTE; WYANDOTTE; WYOMING, and others.

Mexican and Central American Indians. The Mayans (*see* MAYA), occupying the Yucatan Peninsula, were probably the leaders in Mexican civilization. They had a written language, a well-developed architecture (*see* MAYA ARCHITECTURE), and an elaborate system of government and religion. The Aztecs (*see* AZTEC), with their capital at what is now Mexico City, had also reached a high level of culture, and were familiar with the manufacture of bronze. Other tribes, although somewhat inferior to the Mayans and Aztecs, were for the most part superior to the North American Indians. (*See also* MEXICAN AND CENTRAL AMERICAN INDIANS, LANGUAGES OF.)

South American Indians. The South American Indians, particularly in the north Andean region, likewise showed greater progress than the northern races. Their agricultural products were grown in greater variety and were more extensively cultivated; the leading crops were manioc, potatoes, corn and tobacco. Cotton and pineapple culture was also established. Most progressive were the Incas (*see* INCA), who domesticated the llama and alpaca, wove cotton cloth, and employed an effective irrigating system. Government and religion were well-organized, and buildings were erected on an impressive scale. Vessels and small implements were often made of gold and silver.

In the eastern, central and southern sections of South America, the Indians were more primitive. In the Upper Amazon region they hunted with a blow-gun loaded with poisoned darts, and subsisted mainly an animal food. In the Amazon basin, however, the natives were to some extent agriculturists, and cultivated manioc, potatoes, tobacco and cotton. The Indians in the southern part of the continent were primarily hunters. In some districts they made crude implements of iron. (*See also* SOUTH AMERICAN AND ANTILLEAN INDIANS, LANGUAGES OF.)

INDIAN TOBACCO (*Lobelia inflata*), a medicinal plant of the lobelia family called also eyebright and asthma-weed. It grows in dry soils from Labrador to Saskatchewan and southward to Georgia and Arkansas. The branching, leafy stem, about 2 ft. high, bears thin oblong leaves, narrow clusters of small blue flowers and much inflated pods. Most parts of the plant contain a powerful narcotic alkaloid known as lobeline. Medicinal preparations from Indian tobacco are used as an antispasmodic in the treatment of asthma.

INDIAN TURNIP, a name sometimes given to the common JACK-IN-THE-PULPIT of the eastern United States because of the turnip-shaped root, formerly used for food by the Iroquois and other Indians.

INDICATORS, CHEMICAL, soluble chemical substances which undergo marked changes in color during a narrow interval of change in their ionic environment in the same solution, and are widely used to indicate the quantitative completion of a chemical reaction. The most important are those which change color when the reaction of the solution changes from acidic to alkaline or vice versa, such as phenolphthalein, which is colorless in an acid environment, but deep red in an alkaline. The change here is caused by the fact that phenolphthalein is a very weak acid which is practically undissociated so long as the HYDROGEN-ION CONCENTRATION is greater than that of a neutral solution, but which, in an alkaline solution dissociates, and undergoes an internal change of structure, which is accompanied by a pronounced change in color. Methyl orange, methyl red, and litmus are some of the better known indicators, all of which are used in the quantitative determination, by titration of acids and bases by each other. Indicators used in different reactions include potassium chromate which is used to indicate the completion of titration of chlorides with silver solutions. *See also* IONIC THEORY.

INDICTMENT, a formal accusation in writing by a GRAND JURY charging the accused with a specified crime. In general the indictment is drawn by the prosecutor and laid before the Grand Jury which hears the evidence, and if it determines that there is probable cause for prosecution, finds the indictment, the foreman endorsing it "A true bill." If the grand jury does not find probable cause it ignores the indictment which is then endorsed "Not a true bill" or some equivalent phase. The rules governing indictment are so strict and technical that prosecution by information is superseding prosecution by indictment in an increasing number of states.

INDIES, LAWS OF THE. The body of Spanish colonial laws resting on the authority of the Crown, or of the Crown and the Cortes, made up of royal orders, ordinances, instructions and despatches as well as of legislation. With the Spanish conquests in the New World, the civil law was taken over in the Spanish colonies as the common law of England was taken over in the English colonies. But in each case adaptation to colonial conditions was necessary, and the Roman tradition of codification naturally impelled codification of the law as modified and adapted. The first compilation was published in 1563, and this was followed by further compilations in 1596 and 1628. These were superseded by the *Recopilacion de leyes de los Reinos de las Indias.* The last official edition of this code was published by the Spanish government in 1841. There have been many subsequent private editions with governmental approval. As the basis of Spanish law in the New World, this code has some importance for the law of Louisiana and Texas, where Spanish law is an element in the legal system, and much importance for the law of Porto Rico and the Philippines.

INDIGO, the common name for a numerous genus (*Indigofera*) of shrubs and perennial herbs of the pea family, some of which are valued as dye-plants and as ornamentals. There are about 300 species, natives chiefly of tropical regions, several occurring in the southern United States. They are mostly silky-hairy plants with divided leaves and small purple, pink or white flowers borne in axillary clusters. Commercial indigo, a valuable blue dye-stuff, known to the Romans and Egyptians, is obtained chiefly from a shrubby species (*I. suffruticosa*), native probably to India where its cultivation dates from ancient times. Indigo dyes, now manufactured synthetically, have largely replaced the natural product.

INDIGO, a blue vegetable dye and one of the oldest and most valuable dyes known. Its chemical formula is $C_{16}H_{16}O_2N_2$. Natural indigo occurs in leaves of various species of *Indigofere,* which were cultivated extensively in India, China, Japan, South America and in the American colonies before the Revolution. The dye occurs in the plant as a glucoside, indican, which by enzymatic hydrolysis and subse-

quent oxidation is converted into the insoluble indoxyl or indigo blue. In 1870, Von Baeyer discovered the synthesis of artificial indigo and by 1897 it was commercially manufactured from coal tar products. Synthetic indigo has gradually replaced the natural product and now about 90% of it is artificial. Natural indigo is impure, being contaminated with indigo red and other closely related compounds, while synthetic indigo is uniform and gives more satisfactory results. Indigo is a dark blue crystalline powder, insoluble in water, but soluble in aniline. It is applied to cotton by reduction to colorless indoxyl and subsequent oxidation. J. E. C.

INDIGO BUNTING (*Passerina cyanea*), a handsome little bird of the finch family (*Fringillidæ*) common in summer in eastern North America and wintering from Mexico and Cuba to Panama. It is about 5½ in. long, the male having bright indigo-blue plumage, with black wings and tail, and the plainer sparrow-like female gray and brown plumage. It is a pleasing and tireless songster, building a compact nest in the fork of a bush and laying 3 or 4 pale bluish-white eggs.

INDIGO SNAKE. *See* GOPHER SNAKE.

INDIRECT METHOD OF PROOF, the method which begins by saying that there are only n possibilities to be considered, and proceeds to show that $n - 1$ of them are not allowable, hence drawing the conclusion that the remaining one is true. For example, if we know that $A > B$, $A = B$, or $A < B$, and if we can show that A cannot be either greater or less than B, then we know that $A = B$. It is also known as proof by exclusion or the *reductio ad absurdum.*

INDIUM, a very rare metallic chemical element, symbol In, atomic weight 114.8, belonging to the same group as aluminum and gallium. As a metal it is white, soft, and easily malleable. It occurs in nature in connection with zinc, and was discovered spectroscopically by Reich and Richter in 1863.

INDIVIDUALISM, the theory that the welfare of society rests on the unimpeded activity of the individual. This theory came into prominence in the latter half of the 18th century, before the era of machinery and large business enterprises. The governments of Europe were monarchies, some, like France, granting the king almost absolute power, and there existed a body of taxes, tariffs and laws regulating trade and industry and greatly restricting individual initiative.

A school of French thinkers, the Physiocrats, propounded the theory that commerce and industry should be allowed to develop entirely unrestricted. Man, in their view, had a natural right to liberty. The enlightened selfishness of each individual would cause him to seek his own highest good; free competition would stimulate activity and the sum of individual prosperity would constitute the prosperity of the state. Adam Smith, the English economist, outlined this doctrine in his famous book, *Wealth of Nations* and it undoubtedly influenced the makers of the American constitution.

The Industrial Revolution, beginning in the last quarter of the 18th century, substituted machine labor for hand labor and large corporate businesses for one-man enterprises. Individual laborers, finding that their rights were meaningless as opposed to organized capital, organized for collective bargaining.

The principle of group organization has permeated modern life. Not only manufacturing, selling and political activity are carried on through large groups but the tendency is toward organization for buying, for housing, for farming, for amusement, for athletics. The demand for unhampered activity of the individual is now giving place to a demand for a wise regulation of group activities. R. M. U.

INDIVIDUAL PSYCHOLOGY, the psychology of the individual as over against social psychology; the psychology of individual differences; the Adler school. Although individual and social psychology are not distinct from each other, there is a difference in the matter of emphasis. In individual psychology the emphasis is placed upon individual behavior rather than behavior in its social aspects. The study of individual differences is also known as individual psychology. This includes such matters as temperament and attitudes. Differences in intelligence and abilities are also matters for individual psychology. Such types as the genius, the defective, and the criminal fall under this head.

The Adler school has developed an individual psychology. It is somewhat eclectic in point of view, being a combination of Freudianism, phenomenology and behaviorism. The method of case study is very important in connection with the work of the school. The school has been interested in the treatment of crime and delinquency. A child of psychoanalysis, it has been most successful in the realm of psychopathology. This individual psychology is psychoanalytic in its point of view, and at the same time tries to apply behavioristic methods. It differs from behaviorism in that it stresses the importance of the inner life, thus being in sympathy with German phenomenology.

INDO-CHINA, FRENCH, the eastern portion of the Indo-Chinese peninsula bounded on the north by China, south and east by the China Sea and the Gulf of Tonking, and west by the Gulf of Siam, Siam and Burma. The area is about 285,000 sq. mi. French Indo-China now comprises five areas, the colony of COCHIN-CHINA and the protectorates of CAMBODIA, ANNAM, LAOS and TONKING. These units coincide in some respects with geographical units: Cochin-China and Cambodia include the rice-growing plains of the south; Annam the mountain ridge of the east and its coastal strip; Laos the country behind the Annamese Mountains and cut off by them from the sea; Tonking the Red River basin in the north. In 1900 the territory of KWANGCHOW, 190 sq. mi. area on the coast of China was leased from China.

The region is divided into great basins by chains of mountains and highlands which form offshoots from the great plateaus of Yunnan and southern

China. The great Annamite Cordillera runs from the center of the plateau towards the southeast; it runs parallel to the Annamese coast and separates Annam from Laos. Indo-China also includes the plains of Tongking in the north and the wide flat basin of Cambodia and the delta plains of the Mekong in the south. Lake Tonle Sap is connected with the Mekong by a channel nearly 50 mi. long.

Indo-China is a tropical monsoon land. Its climate is characterized by uniformly high temperature, except on the highlands, and by heavy rainfall during the summer months. The winter northeast monsoon also brings a certain amount of rain from the Pacific.

French influence in Indo-China commenced in 1787 when the ruler of Cochin-China and Louis XVI signed a treaty. French enterprise has developed many plantations, rubber and coconuts in Cochin-China and Cambodia, coffee in Tongking; rice is the most valuable crop of the flood plains. Cotton is increasing in importance. Cambodia is famous for its pepper. Other native crops are tea, maize, tobacco and peanuts. The rearing of cattle and buffalos for meat and for draft purposes is important. The mountains of the east are rich in minerals. Coal mines occur in Tonking and Annam, and other minerals are zinc, antimony, tin and wolfram, all found in Tonking.

There are lines of railroads from each of the important centers of HAIPHONG, Tourane and SAIGON. The hinterland of Haiphong comprises Tongking, northern Annam and northern Laos; the hinterland of Tourane is central Annam, a narrow strip of coastland backed by high mountains; and Saigon's hinterland comprises Cochin-China, Cambodia, and the rice growing sections of southern Laos and Annam. The rivers are at present the important highways. Fairly large ocean steamers can reach PNOM PENH, Cambodia, which is also the center of the road system, there being over 1,200 mi. of metaled highways. Est. pop. 1930, 21,262,000.

INDO-EUROPEAN, a family of languages (*see* FAMILY, LINGUISTIC) spoken in the northern half of India, most of the Iranian Plateau, a small area of the Caucasus region, all Europe (excepting for Hungarian, Finno-Ugric and Basque, and, in ancient times, in parts of Turkestan and Asia Minor. From Europe, they have spread—especially English, French, Spanish and Portuguese—over wide areas throughout the world, and practically dominate North, Central and South America. They are divided into ten major groups which are in rough geographical order: Indo-Iranian, Armenian, Greek, Albanian, Italic (whence the important Romance languages), Celtic, Germanic, Baltic and Slavic, besides such extinct branches as Kanisian, Tokharian, Illyrian and Ligurian (*see* articles on these subjects). During their migrations, the Indo-European languages supplanted the speech of earlier inhabitants, excepting that of the Basques, though isolated words of these aboriginal tongues still survive. Conventionally the family falls into two groups of *centum-* and *satem*-languages (*see* CENTUM-LANGUAGES; SATEM-LANGUAGES). For linguistic research the most important branches are Sanskrit, Greek and Lithuanian, and for literature, Sanskrit, Greek, Latin, Romance, English and German (*see also* these subjects under their separate titles). Scientific study of language has been devoted more intensively to Indo-European than to any other linguistic family, and it contains, with the exception of the Bible and ARABIC, practically all the world's best literature. The group is often called Indo-Germanic from the two extremes of its distribution, India and the Germanic tongue of Iceland; the term Aryan sometimes applied to it can properly be used, if used at all, only of INDO-IRANIAN. L. H. G.

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INDO-IRANIAN, a group of INDO-EUROPEAN languages spoken in the northern half of India, most of the Iranian Plateau, a small area of the Caucasus and formerly in parts of Turkestan. It falls into the subdivisions of 1. Indian: Sanskrit, Prakrit (including Pali), and Modern Indian; and 2. Iranian: Old Persian, Avesta, Pahlavi, Modern Persian, Kurdish, Balochi, Afghan, Ossetic and the extinct Sogdian, Sakian, Parthian and Sarmatian, with 3. a transitional group in Dardic and Ormuri. *See also* separate articles on these subjects.

INDOLE, a peculiar organic chemical compound, derived from pyrrole, and which in the pure form possesses the faint, but pleasant aroma of jasmine flowers, and is used in perfumes. It occurs generally with the closely related substance scatol, having a strong odor of human feces, of which it is one of the chief contributing smells.

INDONESIAN, a group of the MALAYO-POLYNESIAN linguistic family spoken in Formosa, the Malay Peninsula, the Philippines, Borneo, Celebes, Ceram, Aru, Timor, Java, Sumatra, Madagascar, etc. They fall into many dialects, the Philippines alone having about 40, of which TAGALOG is the most important; Celebes, over 20; Sumatra, six, of which Batak, with an equal number of sub-dialects, is chief; but only Javanese is known from an early date. The alphabets are derived either from South Indian in the regions where the civilization of India made a deep impress (Old Philippine, Celebes, Bali, Madura, Java, Sumatra), from Arabic where Mohammedanism has been powerful (Sumatra, Moluccas, Moros in the Philippines, Java, Sunda), or from Roman.

As in Malayo-Polynesian generally, the BASE is essentially monosyllabic, though generally it appears to be dissyllabic because of prefixed determinants. GENDER and NUMBER are lacking, the latter being expressed by repetition of the word, by a collective, or

by a term meaning "many" or the like; CASE is indicated by position or by prepositions; there are no less than seven types of articles; the personal pronouns have two forms, isolated and suffixal; and the verb, which frequently can be distinguished from the noun only by the context, has three tenses, present, past and future, as well as active and passive voices, construction with the latter being preferred.

L. H. G.

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INDORE, a city and native state in the Central India agency. The city, located at the confluence of the Khan and Saraswati rivers, and served by the Ajmere-Khandwa railroad, is the capital of the state and an important grain trading center. At the British Residency, east of the city, is Daly College for Indian princes. The State of Indore is bounded by the Vindha Range on the north, and the Satpara Hills on the south. Its principal river is the Nerbudda. About one-fifth of the area of 9,519 sq. mi. is under cultivation and produces chiefly grain and cotton. Originally created for Malhar Rao Holkar (1694-1766), Indore is ruled by the Maharaja Holkar; there has been a British resident since 1899. Pop. 1921, city, 93,091; state, 1,151,598; 1931, city, 127,151; district, 1,315,902.

INDORSEMENT or **ENDORSEMENT,** a writing or signature, usually by the payee, on a note or on other negotiable instruments. Ordinarily, indorsement refers to a signature on the back of a BILL OF EXCHANGE or note which, when accompanied by delivery, transfers title to the paper. However, a signature on the face of the paper or on another paper attached to the instrument negotiated is valid as an indorsement according to the Negotiable Instruments Law. The mere writing of one's signature on the back of a bill or note does not effect transfer of title to such paper. Delivery is essential to complete the transfer. In the case of a note payable to bearer, transference is accomplished by delivery alone. Thus, bearer instruments may pass from hand to hand without indorsement. The effect of most but not all indorsements, besides transferring title from one holder of a negotiable instrument to another, is to render an indorser liable to payment of the paper in the event it is dishonored by non-acceptance or non-payment. Such liability is generally conditioned, however, upon due presentment to the drawee or maker for acceptance or payment of the paper and upon notice of dishonor being given to the indorser (N. I. L., Section 89). The indorsement must be of the entire instrument but it may be special or in blank, qualified, conditional or restrictive. Special indorsements specify by name the person to whom the instrument is payable whereas indorsements in blank name no indorsee, thereby making the paper payable to bearer. An indorsement may be qualified by adding to the indorser's signature the words without recourse, indicating non-liability of the indorser to subsequent transferees. By restrictive indorsement, further negotiation of the instrument is prohibited or the indorsee is constituted the agent of the indorser.

A person who lends his name to aid another's credit by indorsing a negotiable instrument without receiving value therefor is an accommodation indorser. The accommodation indorser is not liable to the accommodated party, but should the principal debtor fail to make payment when due, recovery may be had from the accommodation indorser, who is liable to a holder for value (N. I. L., Section 29). *See also* NEGOTIABLE INSTRUMENT.

C. F. WE.

INDRI, a lemur (*Indris indris*) native to Madagascar, called also babakoto. It is the largest and most highly developed of the lemur order, and when it comes to the ground, walks on its hind legs alone. Its home is in the tree-tops, feeding on fruit and leaves and also on birds, which it is adept at catching. Its woolly coat is black and white. Many queer legends center about the indri which is noted for its doleful howls.

INDUCTANCE, the capacity possessed by an electrical circuit for electromagnetic INDUCTION either on itself or on neighboring circuits. There are two types, *self-inductance* and *mutual inductance.* Self-inductance, or coefficient of self induction, is the factor by which the rate of change of current in a coil is multiplied to give the counter electromotive force which the change induces. Mutual inductance between two circuits is the factor by which the rate of change of current in one circuit is multiplied to give the electromotive force induced in the other circuit.

INDUCTION, in magnetism, the process by which a CONDUCTOR or body of magnetizable material becomes charged or magnetized by a charge or MAGNET without contact therewith. An electrostatic charge is induced in any conductor brought into the presence of a charged body. If the conductor is insulated, the induced charges disappear upon the removal of the inducing charge. The effect is the result of a displacement or redistribution of the ELECTRONS in the conductor, brought about by the action of the inducing charge. If the inducing charge is negative, the electrons in the conductor are repelled by it to the remote parts of the conductor. This collection of electrons constitutes a negative charge. The removal of electrons from the nearer parts of the conductor leaves those portions charged positively.

When a piece of magnetic material is brought near to a magnet or placed in a magnetic field, it is temporarily magnetized by induction. The effect of the magnetic field is to rearrange the "molecular magnets" in the material in the order in which they are found in a permanent magnet. When the material is removed from the magnetic field, the molecular magnets tend to fall back into an irregular arrangement, and the magnetism disappears.

Electromagnetic induction is the production of an electromotive force by the motion of a conductor in a magnetic field. Experiment shows that any conductor which is caused to move across a magnetic field has an electromotive force induced in it which is propor-

tional to the length of the wire, the intensity of the field and the velocity of the conductor in a direction perpendicular to the magnetic lines of force. If the conductor is stationary and the field moves relative thereto the effect is the same. When a current is started or stopped in a coil, magnetic lines of force swing across the coil; in effect, the wires of the coil cut lines of force, or move across the field. The resulting electromotive force in the coil is self-induced and the effect is *self-induction.* When a changing current in one coil produces an electromotive force in another, the effect is called *mutual induction. See also* ELECTRICITY; MAGNETISM. L. B. S.

INDUCTION, in logic, reasoning from the particular to the general, the opposite of DEDUCTION. From a number of particular instances a general conclusion is drawn. By observing the regularities and uniformities in the paths of falling bodies, Newton was able to arrive at the great generalization expressed in the law of gravitation; by observing a countless number of forms of life Darwin arrived at the grand generalization embodied in the principle of organic evolution.

The inductive method was first used in western thought by Socrates in his examination of concepts. Although Aristotle used it to some extent in arriving at his definitions, it is with the deductive method that his name is usually identified. The inductive method disappeared almost entirely during the Middle Ages and began to appear again only in the 17th century, principally through the efforts of FRANCIS BACON, who was sometimes called the father of induction.

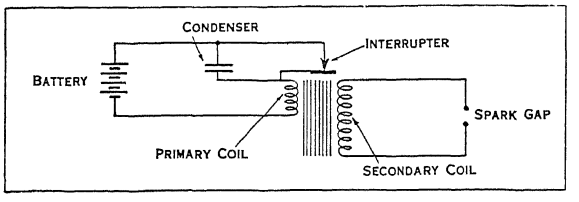
The most complete induction is based on the examination of all instances of a law or relation, but this is usually impossible. In mathematics one instance is as good as a thousand; but in dealing with concrete things, induction requires a leap of generalization. This leap should be based on the examination of a sufficient number of typical instances to warrant it and should be otherwise carefully controlled. It was JOHN STUART MILL who formulated the canons of induction.

INDUCTION, in mathematics, a method of demonstration based on the assumption that if a property is true for any number n and also for the number next greater than n, and if at the same time it is true for any number p, then it will necessarily belong to all numbers greater than p. Usually this process is carried on as follows: Given a sequence of odd natural numbers, 1, 3, 5, ... , n, the successive sums of the odd natural numbers will be 1, 4, 9, ... , and hence we may conclude that the sum of the first n odd natural numbers is $S_n = n^2$. By inspection we see that this is true for S_1, S_2, S_3, ... Assume that it is true for S_k. Then we find that

$$S_{k+1} = S_k + (2k + 1) = k^2 + 2k + 1 = (k+1)^2.$$

Since it has been found by inspection that the inference is true for S_1, and it is true for S_{k+1} if it is true for S_k, it is generally true, and hence $S_n = n^2$.

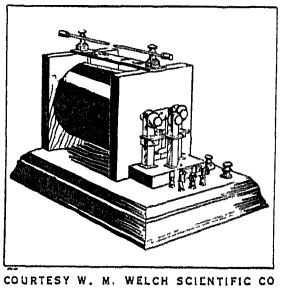
INDUCTION COIL, a device for producing large electromotive forces by electromagnetic INDUCTION. It consists of a bundle of soft iron wires called the *core.* over which are wound two coils of insulated wire. The *primary coil,* usually placed immediately upon the core, consists of a few turns of heavy wire. The *secondary coil,* usually wound directly upon the primary, comprises many turns of fine wire. The primary coil is connected to a source of current by means of a



WIRING DIAGRAM OF INDUCTION COIL

switch and to an interrupter which operates to rapidly open and close the primary circuit. Each time the core is magnetized by the primary current, or demagnetized through the action of the interrupter, an electromotive force is induced in the secondary. The electromotive force developed in this manner between the terminals of the secondary coil may be enormously large as compared to that of the source connected to the primary coil. This is true because an electromotive force is induced in each of the many turns of the secondary, and because the total electromotive force between the secondary terminals is the sum of the electromotive forces of the individual turns.

The secondary electromotive force induced at the breaking of the primary circuit is much greater than that induced when the circuit closed, or "made," since it is possible to stop the primary current much more suddenly than to start it, and since the secondary electromotive force is proportional to the suddenness with which the core is magnetized or demagnetized. A sudden demagnetization of the core at the moment the primary circuit is broken is secured by the use of a CONDENSER bridged across the break in the primary made by the interrupter. The condenser also acts to suppress self-induction in the primary, which otherwise would oppose the collapse of the magnetic field and thereby reduce the voltage induced in the secondary. L. B. S.



COURTESY W. M. WELCH SCIENTIFIC CO

INDUCTION COIL

The interrupter is shown at the end of the coil. Above the coil is a spark gap, across which the high voltage discharges

INDULGENCE, a term defined as the remission of temporal penalties due to sin after its guilt has been forgiven. The early Church exacted public penance for sin that was gradually replaced by private penance. Thus crusades, fighting heretics, pilgrimages and alms giving, became popular forms of penance.

The Council of Clermont, 1095, for instance, offered the pilgrimage to Jerusalem "in lieu of all penance." Boniface VIII proclaimed the first great jubilee Indulgence in 1300, while a little later Wycliffe criticized the giving of 2,000 years of Indulgences for a single prayer. Sin could be remitted only after repentance and absolution through the Sacrament. The indulgence may be total or partial. The fact that the ignorant came to confuse forgiveness for sin and remission of punishment and believed that both could be bought and sold led to the protest of Luther in 1517 that inaugurated the Protestant Reformation. Since the Council of Trent the doctrine has been carefully safeguarded by the Catholic Church.

INDULINES, a very numerous group of organic dyes, generally from deep blue to dark red in color, and related to the SAFRANINES. They are made by the action of amino-azo compounds upon amines in the presence of small amounts of acid; if the temperature is kept low, red shades are formed, but during a prolonged application of greater heat, blue shades result. Indulines are ordinarily soluble only in alcohol, but after sulphonation may become soluble in water; they form very "fast" blues, and are much used in printing.

INDUS (gen. *Indi*), the Indian, a constellation southeast of Sagittarius, containing two stars of the third magnitude. The star Epsilon Indi, of the fifth magnitude, is one of the nearest stars, only 11.6 light years distant. It is 7 times fainter than the sun and has a speed of 54 miles per second. *See* STAR: *map.*

INDUS, a river of northwest India, rising in Tibet on the north of the Himalayas and flowing into the Indian Ocean after a course of 1,800 mi. The course for the first 500 mi. is northwestward through a ravine of remarkable depth and between mountain ranges whose height and grandeur are unsurpassed. Until it emerges from the mountains just above Attock, the river is at all times a raging, ungovernable torrent, having dropped 10,000 ft. in 500 mi. At Attock it is only 1,000 ft. above sea level, so that thence to its mouth, a distance of 1,000 mi., its speed is normal. On the left bank the Indus is swelled in its middle course by the inflow of the united waters of four large glacier-fed rivers: Sutlej, Ravi, Chenab and Jhelam. At Hyderabad the delta begins and the river sends off numerous distributaries.

The permanent source of the waters of the river and its tributaries is the melting snows and glaciers of the Himalayas and western border ranges, and these are considerably augmented by the summer monsoon, just when the glacier water is at the maximum. Thus about August the river and its tributaries burst the banks of the many channels into which each splits in the Punjab and flood the country for miles. During winter and spring the rivers are low in their middle courses and useless for navigation and natural irrigation. The latter disadvantage is being overcome by extensive irrigation works. From Sukker to the sea the level of the river is above that of the surrounding land.

The Indus and its tributaries are shifting their beds westward. The large towns are on the left bank, from which they are now some miles distant, e.g., Multan 7 mi., Lahore 2 mi., Hyderabad 7 mi. From its junction with the Chenab the Indus receives practically no tributary waters; it is swollen annually by waters that fall far from its lower course; the land through which it flows is saved from utter desert conditions only by annual floods and irrigation works; its deltaic course is through malaria-stricken lagoons and marshes. The delta has a sea frontage of 120 mi., and the river is navigable by vessels of light draught for only a short distance.

INDUSTRIAL ACCIDENTS, accidents due to industrial conditions. Such mishaps cause a loss to industry and to individuals that, conservatively estimated, aggregates in the United States almost one billion dollars a year. Systematic efforts to reduce this loss began about 1918. Where state compensation laws have been enacted, interest in accident prevention showed a remarkable growth. In 1908 the Department of Commerce estimated that there were 35,000 fatal and not less than 2,000,000 non-fatal industrial accidents each year, imposing a burden on industry, for maintaining hospitals and other institutions as well as for the care of dependent families, totalling hundreds of millions of dollars. Investigation revealed that from 50 to 80% of such accidents are preventable, mechanical safeguards accounting for one-half of this reduction and safety education the balance. The United States Steel Corporation, with 250,000 employees, reduced its accidents 88% from 1912 to 1927; the Chicago & Northwestern Railway from 1910 to 1914 reduced all accidents 34% and fatalities 39% while increasing its mileage by 6%; in the same period the Eastman Kodak Company reduced its accidents by 75%.

Education in prevention consists of the formation of safety councils among workmen, publication of safety bulletins, pictures and slogans, and in training foreign workers in safety measures while they are learning to speak English. Among other measures employed are the installation of mechanical safeguards, removal of fire hazards and supervision by safety engineers (*see* SAFETY ENGINEERING). The National SAFETY COUNCIL serves as a general clearing house for information, issues weekly bulletins and publishes statistical information. The Safety Institute of New York maintains a permanent exhibition. The Departments of Commerce, Labor and the Interior, and the International Commerce Commission also maintain safety organizations. *See also* ACCIDENT PREVENTION.

INDUSTRIAL CHEMISTRY, that branch of chemistry which applies chemical reactions to the purification of natural materials or to the preparation of synthetic products from natural raw materials. It includes not only the basic industries, such as the extraction of metals from ores, the manufacture of steel and alloys, the production of tars and gaseous fuels from coal, and the refining of petroleum, but also the

manufacture of heavy chemicals like sulphuric acid, caustic soda, chlorine and lime, on which are built the complicated processes involved in the manufacture of synthetic products such as dyes, perfumes and medicinals from coal tar, solvents from natural gas, alcohols from starches and sugars, rayon and a host of plastic materials from cellulose, special foods from grain and dairy products, and medicinal extracts from packing house materials. Every industrial process which involves more than a mechanical alteration is a chemical one, and industrial chemistry thus includes such reactions as fermentation, the plating of metals, photography, the cooking of foods, baking, purification of water, sewage disposal, and the manufacture of glass, porcelain, rubber, leather, paper. In general, the chemical industries are those which depend upon carefully controlled chemical reactions produced by chemical means and supervised by chemists and chemical engineers. *See also* CHEMICAL ENGINEERING.

G. L. W.

INDUSTRIAL COORDINATION, a term applied to the organization of the various factors of a single business enterprise with reference to a predetermined sales program. It also includes the cooperation of formerly competing industrial concerns in a unified plan for the marketing of their products, or to achieve other business advantages, the unified control of the major industrial processes of a whole nation for the purpose of achieving a specific objective, such as the winning of a war, or the abolition of the system of private property in the means of production and DISTRIBUTION OF WEALTH, and the substitution of some form of SOCIALISM or COMMUNISM by which, theoretically, production and distribution shall be carried on for use and not for profit.

Modern INDUSTRIAL MANAGEMENT in America emphasized the necessity of synchronizing all the processes within a given factory so that each department will receive its materials to the best advantage of the factory as a whole. Such coordination notably increased production but it was soon discovered that increased production without increased selling (*see* SALESMANSHIP) was unprofitable; and the necessity of selling the increasing volume of goods led to many experiments in high-pressure salesmanship.

Then followed experiments in planning sales for a considerable period ahead and adjusting the volume of production in accordance with these plans. The most successful industries were those which discovered that sales could be most inexpensively increased through lowering prices and giving better values.

Opposition to socialism and to government ownership gradually switched, especially in big business circles. A new movement for industrial coordination developed, particularly after the business breakdown and the widespread unemployment which followed the era of feverish SPECULATION in 1929.

The new capitalism favored high wages and, whether faced with competition or not, sought to make prices lower and lower. This led to a complete new theory of economics, and to a remarkable increase in the STANDARD OF LIVING in America (where the new capitalism had reached its highest peak) but it became evident that the most basic social problem had not yet been solved. That, as many business leaders now saw it, was the problem, not planning production to meet the market demands, but planning CONSUMPTION so that it would keep pace with the ever-increasing volume of production. C. W. W.

INDUSTRIAL COUNCILS (Eng. only). *See* WHITLEY COUNCIL; STRIKES.

INDUSTRIAL DEMOCRACY, a phrase to which numerous meanings have been attached. In England when Sidney and Beatrice Webb wrote their definitive work on collective bargaining with labor organizations they entitled it *Industrial Democracy* on the theory that the autonomous and spontaneous efforts of organized workers to take a hand in determining wage, hours and working conditions constituted a long step toward democratic control. But in the United States the activities of LABOR ORGANIZATIONS have never been sufficiently inclusive or universal to lend much significance to the phrase as applied merely to COLLECTIVE BARGAINING activities.

The phrase was also appropriated, almost as a trade mark, by one exponent of the idea that the form of the Federal Government structure could be applied to the structure of a representative government plan within corporations. The head executives were to constitute the Supreme Court; the foremen the Senate; and the delegates from the rank and file would be the House of Representatives. In action, however, this plan proved inelastic, artificial and ill adapted to effective intergroup deliberation. And most of these installations have either been drastically modified or abandoned.

A further application of the phrase is to those individual companies which are owned in whole or substantial part by their employees who thus exercise democratic control through their membership on the Board of Directors. Clearly this use limits the notion of democracy to the particular company rather than envisaging the control of larger national or international economic factors in some democratic manner.

Again, the phrase is sometimes used as a synonym for socialism, thus giving an emphasis to the idea of industrial reorganization along more democratic lines, and assuming presumably some form of public ownership and control of industry.

Finally, the phrase is used in a frankly symbolic or idealistic sense to give a name to an aspiration toward some kind of national and international economic development, the form to be worked out empirically, which would fit in with the dictum of a government of, for and by the people, with control derived from the active consent of the governed, with the ultimate sovereignty residing in the people as a whole, and with the motive of private profit made secondary to the motive of public service. And without wishing to commit themselves to any one formula some people see in industrial democracy a slogan to denominate an ideal to be striven for. O. T.

INDUSTRIAL EDUCATION. This term is generally applied to the training of manual workers in trades and industries. With the extension of universal general education to all, industrial education is almost everywhere now postponed until after the completion of the elementary school, although with the changing character of elementary education practical arts and manual work are more and more being introduced into the curriculum. Industrial education owes its origin to the rise of the factory system in the 18th century and the gradual disappearance of apprenticeship training. The development of division of labor with machine processes has led to a demand for a large number of low-grade workers who can easily be trained on the job and for a smaller number who need somewhat extensive training. Since employers were unwilling in most cases to undertake the cost of training their employees and largely under the impulse of international competition, most countries have established schools of various grades to provide the industrial education needed. Into the historical development of industrial education it is impossible to enter here.

England. Industrial education in England is provided in a wide range of schools including continuation and part-time schools, evening schools, and full-time day schools. The attempt made in 1918 to make attendance at continuation schools compulsory failed, but it was intended by the law of that year to organize a great variety of courses based on the occupations in which the pupils were engaged. In the evening schools graded courses are provided beginning with an emphasis on basic general subjects such as English, mathematics, science and drawing, and leading to courses in branch institutes or technical schools in engineering, chemical and building trades, and other industries depending upon the locality. Provision of a corresponding nature exists for training young women for the needle trades and domestic courses. Full-time industrial courses are provided in junior technical schools for boys and girls between the ages of 14 and 17; here again the courses vary with the localities but include in general engineering, building, printing and furniture trades for boys, and needle trades, photography and domestic occupation for girls. Still more highly specialized and scientific are the technical schools and colleges which are open to students of about 16 years of age who in some cases may be required to have had some workshop experience. While all technical schools provide adequately for practical work, some require their students to visit workshops, and a few employ the "sandwich" system whereby the students spend part of their time in the school and part in the works. Advanced industrial education in various branches is given in the universities.

France. Industrial education in France has a long history which goes back to the 18th century. A variety of schools of arts and crafts, some general, some specialized, sprang up early in the 19th century; but it was not until the end of the century that serious attention was given to the question. A general reorganization took place under the Loi Astier in 1919. Employers are required to allow their apprentices to attend vocational courses, for the maintenance of which they pay a tax. Full-time courses are provided in the practical schools of industry for boys and girls, whose work is adapted to local needs. Above these are a number of trade schools. For the training of foremen, managers and supervisors there are national vocational schools, each one specializing and offering a course of three or four years to selected students. High vocational training is given in special institutes and in the national schools of arts and crafts. State certificates granted on the conclusion of the various courses confer a sanction on them. Recently much activity has been displayed in introducing vocational guidance for the students.

Germany. Industrial education which enjoyed a position of importance in the German Empire has become even more essential in post-War Germany. Bureaus of vocational guidance have been established everywhere culminating in a Federal Institute for Vocational Bureaus. The lowest grade of industrial education is provided in compulsory continuation schools, now called *Berufsschulen,* in which the work is based on the occupations of the pupils between 14 and 18. Employers are required to contribute to the maintenance of these schools on the basis of the number of their employees. Full-time training is given in a great variety of schools, ranging from those which require the completion of an elementary education to those based on the completion of six years of secondary education. The length of the courses varies from one to three years. It would be difficult to mention any trade or occupation which does not have its own appropriate schools of a lower and higher level. Thus the mining, stone, metal, machine, chemical, forest by-products, paper, leather, textile, wood, clothing, building, art and graphic industries have their own schools in the organization of which the public authorities, employers and employees participate.

Soviet Russia. Soviet Russia has adopted the policy of giving industrial education directly on the job, that is, in the factories themselves rather than in the schools. In addition attempts are being made to adjust the supply of future workers to the prospective demand not only in each occupation but in different parts of the country.

The United States. Industrial education in the United States is of comparatively recent origin. Interest in MANUAL TRAINING was aroused by the Russian exhibit at the Centennial Exposition in Philadelphia in 1876 and led to the creation of manual training high schools, which did not, however, prove very effective. It was not until 1906 that active efforts led by the National Society for the Promotion of Industrial Education began to be made for the provision of industrial education. In 1914 a Commission on National Aid for Vocational Education was created by Congress, and as a result of its recommendations the Smith-Hughes Act was passed in 1917 to give Federal aid for the promotion of education below college level

in agriculture, trades and industries, home economics and commerce. To carry out the purposes of the Act the Federal Board for Vocational Education was established in 1917 and by additional acts was entrusted with the supervision of vocational rehabilitation of disabled soldiers and civilians. Industrial education is provided in part-time continuation classes, full-time and part-time cooperative classes, and for adults in day and evening classes. In 1928 1,038,008 students were enrolled in vocational classes of all kinds, while the total expenditure was $27,250,592; of this $7,472,221 was from the Federal Government and $19,778,370 from states and localities.

The part-time CONTINUATION SCHOOLS are attended by adolescents over 14 who are already engaged in wage-earning occupations and attend for a minimum of four hours a week. Such schools offer either general courses or trade extension and trade preparatory classes known as cooperative vocational courses. Full-time industrial education is provided in special trade schools or more generally in high schools, under conditions prescribed by the Federal Board. One of the features which distinguishes American secondary education from that in other countries is that the high school, preeminently the school for all adolescents, provides not only academic but vocational preparation of all kinds. Because of the variety of courses thus available in the same institution an elaborate system of educational and VOCATIONAL GUIDANCE has been introduced recently. It may be concluded, therefore, that the majority of students pursuing vocational education do so in the high schools.

A satisfactory program of industrial education depends upon close cooperation between the public authorities, the schools, employers and employees, and upon the careful preparation of teachers, which has not everywhere been satisfactorily solved. In general, however, industrial education promises soon to enter a new era, because of the increasing mechanization of industry, which may require fewer skilled workers and leaders at the top, may reduce the hours of labor, and may ultimately lead to a reconsideration of the relationship between general and industrial education as a foundation for a richer life for the adult.

I. L. K.

BIBLIOGRAPHY.—L. F. Anderson, *History of Manual and Industrial School Education,* 1926. Vocational education in England, France, Germany and the United States is dealt with in the *Educational Yearbook, 1928,* of the International Institute of Teachers College, Columbia University, 1929. A full bibliography accompanies each article.

INDUSTRIAL ELECTRIFICATION, the installation of electric motors, furnaces, processing machinery and the like, together with auxiliary electrical apparatus and generating or distributing facilities, in a factory, mill, chemical establishment or other industrial plant.

INDUSTRIAL GROWTH OF AMERICA. With the coming of the early settlers to America their first efforts were confined to securing an existence so that aside from raising food products they raised only the necessary products from which to make rough clothes. As the settlements grew, small towns developed, which meant that some of these early settlers were being compelled to secure some of the necessities of life from their neighbors on the farms. About 1650 these small towns had increased in number and size to such an extent that it necessitated the passage of laws, requiring members of various families to give a certain amount of their time each year to the manufacturing of clothing from flax and wool and to tanning of hides for shoes. This was the crude beginning of the industrial growth of America, started under legislative pressure.

As the colonies grew, a number of these small towns, such as New York, Boston and Philadelphia, had become fairly large sized cities so that by the time of the American Revolution the demand for manufactured products had become such that it required the entire time for many people to produce the necessary goods instead of part time under legislative pressure. These early efforts were also further stimulated by various offensive acts on the part of Great Britain, who tried to force her goods on the colonies.

Many of the colonies had natural water power which further encouraged the development in these localities of the early manufacturers. With the continued growth of the colonies, the number and variety of the goods produced expanded from articles of clothing to include the metal trades and ship building, so that with the introduction of steam in 1800 and power machinery in 1812 these embryonic manufacturing efforts, which had started in the early settlement days, had now reached the stage where they could be considered the beginnings of industries. But the growth was very slow and had hardly more than reached the stage of being going industries by 1840.

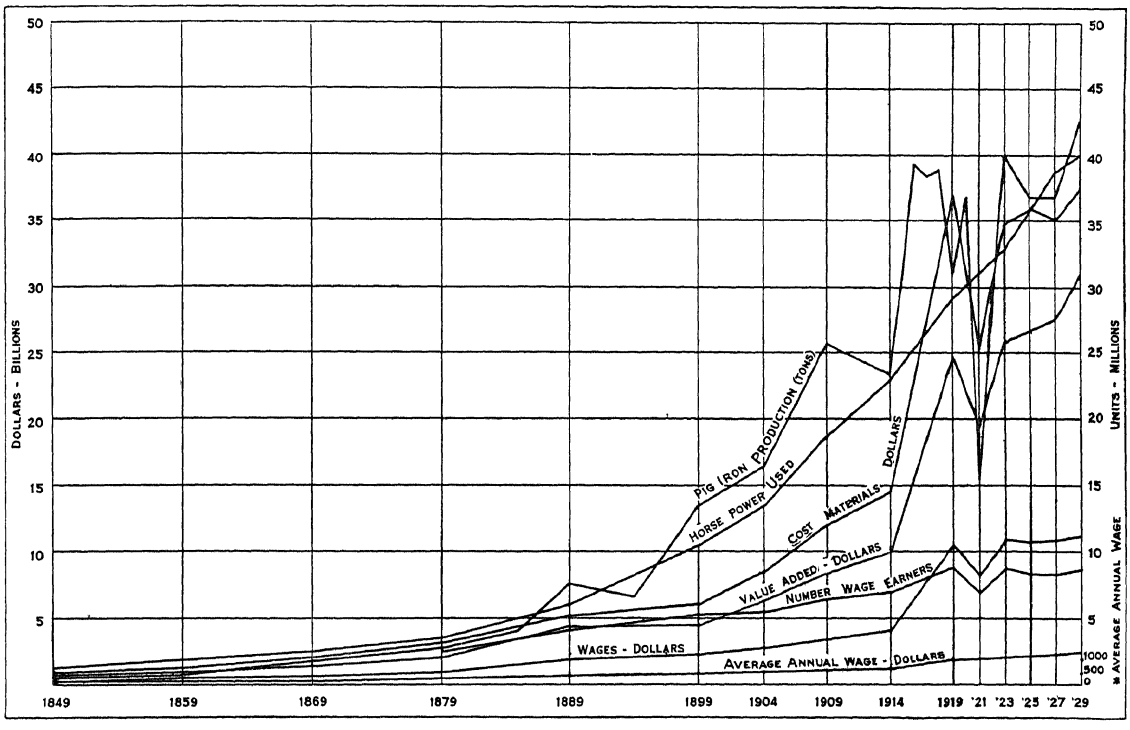
Prior to this time, freight was transported to the inland states by pack and wagon trains and the waterways which included rivers, canals and the Great Lakes. The railroads were mostly along the Atlantic seaboard and very local in character. About this time there were tremendous strides made in the technique of producing iron and steel which had a far reaching effect upon the tremendous expansion and carried the roads west to the Mississippi and in turn gave the young industries the needed impetus which caused them to expand along with the railroads. This expansion was further stimulated by the Civil War.

The records of the industrial progress from 1650 to 1850 are meager and quite unreliable, excepting for a few items, and it was not until 1849 that the first reliable records became available. This industrial growth from 1849 is shown on Chart I by ten-year periods over the next 50 years and by five-year periods over the next 20 years and for every two years since then.

In 1849 the value of products (the sum of cost of materials and the value added) amounted to about one billion dollars and employed slightly less than

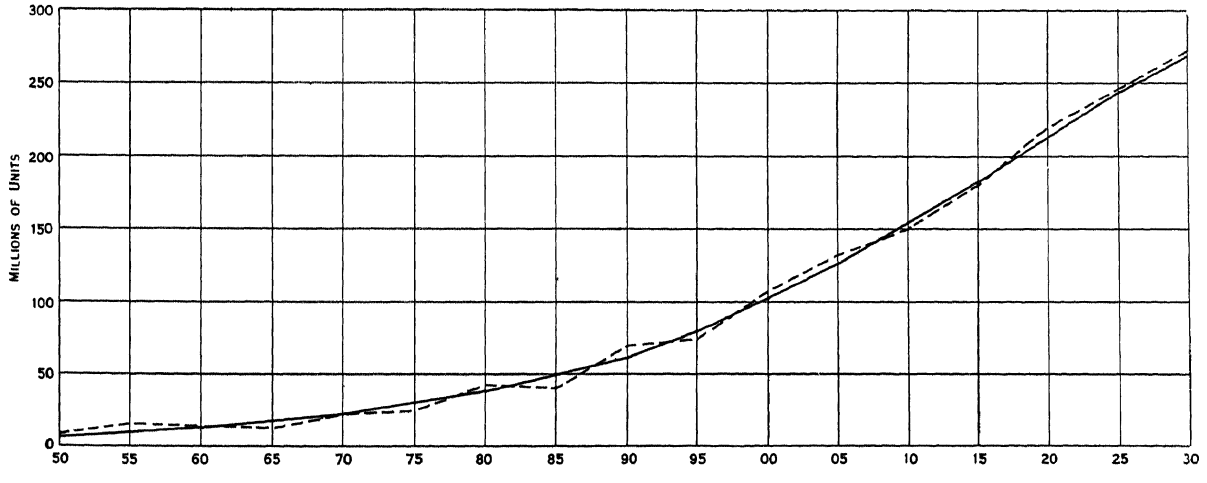
a million people. It will be noticed on the chart that the growth was consistent and regular, reaching in 1899 a volume of goods amounting approximately to 11.4 billion dollars and employing 5 million people. From 1900 to 1914, when the World War began, the growth of American industries had little more than doubled itself, attaining a value of products manufactured (i.e., the cost of materials plus the value added) of slightly over 24 billion dollars and employing over 7 million people. Up to this time the industrial growth of the United States had been more or less natural and regular with no undue influences materially changing its course or affecting its trend such as was evidenced in the following five years as a result of the war.

In 1849 labor averaged about $250 a year and at the end of the 50 year period had reached about $450, a 75% increase. By 1914 the average wage was



CURVES OF INDUSTRIAL INDICES IN AMERICA, 1849-1929

*Showing trends in significant indices of business from 1849 to 1929. * Scale of Average Annual Wage applies only to the curve of Annual Wage*



COMPOSITE INDEX OF THE INDUSTRIAL GROWTH OF THE UNITED STATES FROM 1850 TO 1930 SHOWING ACTUAL GROWTH (*dotted line*) AND NORMAL GROWTH (*full line*)

about $600 a year, whereas in 1919 it was about $1,200. Wages had doubled in a period of five years, due almost entirely to war influences, whereas, during the period from 1899 to 1914 the average wage for labor had increased only one-third. After the war the average wage of labor had gained another 10% which was reflected in a similar gain in the value of the products while the cost of materials had shown no gain.

All industries go through three periods of development in the process of their evolution: namely, the periods of experimentation, exploitation and stability. During the first period a new industry is trying to establish itself in the minds of the public. At this time it is faced chiefly with the problem of desirability of its goods and then with the problem of developing methods and technique in the production of those goods. In the early stages of the industrial growth of the United States people needed the goods that were being produced but the manufacturers were confronted with technical problems of production. From extremely crude methods in 1650 there were many changes in their manufacturing processes, due to the revolutionary effects caused by the invention of the steam engine and later by the introduction of power machinery and as time went along, greatly improved machine tools.

During the early part of the 19th century most of these radical changes had come about and industries found themselves in a period of transition to steam power and power machinery. From then on the industrial growth was dependent largely upon transportation facilities which were crude, slow and uncertain. But, with the expansion of the railroads about 1840, American industries entered the second stage of their development: namely, that of exploitation. During this period the chief problem was that of being able to produce enough to satisfy the demand. Starting about 1840 this period has continued up to and through the war period of 1914-1919, but due to the war influence, which created tremendous gains in manufacturing capacity in most all lines, there is evidence that this period is drawing to a close and that industry has entered the last stage in its development, the period of stability.

In this last stage of the industrial evolution of American industries the chief problem is going to be one of first determining the public demand for the products manufactured and then of producing to meet this demand. Under this procedure each individual manufacturer must determine his relative proportion of the total business and adjust his production schedules accordingly. This is the final stage of development in which the growth of an industry approximates the growth in the population of the country. From this stabilized growth there is no departure unless there is a revolutionary change in the utility of a product which could expand its uses or else a change in the price which would expand the possible number of users. R. B. P.

INDUSTRIAL MANAGEMENT comprises that field of business operation which is concerned with the control and direction of the physical and human aspects of industry. No hard and fast rule defines, within all industrial enterprises, the points or functions at which industrial management begins and ends. Ordinarily it does not include the sales or financial phases of a business, but for the most part is confined to relationships within a plant or industry. It is generally understood to involve the following major functions:

Plant Location—the determination of the best situation for a new or branch plant based on such geographical factors as markets, materials, labor supply, transportation facilities, power, water, supplies, local legislation, civic refinements, financial facilities, and the topography, sewers, workers convenience, fire protection, waste disposal, provision for expansion, land and building costs, advertising value of factory sites.

Plant Layout—the arrangement of buildings, departments, machinery and equipment to provide straight line flow of work, minimum of handling and transportation, economy of space, expansion, balancing of equipment.

Engineering—the design of products, machines and tools; the standardization of products, equipment, tools, materials, methods, quality; the specifications and tests for materials and equipment.

Purchasing—the advantageous procurement of supplies, materials, machinery and equipment; the disposition of waste, scrap, old equipment.

Stores Keeping—the control over requisitioning, housing, issuing and recording of raw materials, parts and supplies to maintain inventories at a minimum and yet prevent shortages of production requirements.

Tool Control—the design, production, housing, issuing and repair of manufacturing accessories in order that production may proceed with proper tools and fixtures.

Employe Relations—the intelligent employment, transfer and dismissal of employes; vocational, physical and mental tests for workers to indicate proper placement; improving working conditions through hours of work, vacations, safety, recreational, vocational and educational activities; furnishing medical, dental and nursing service; improving economic position of workers through profit sharing, stock ownership, insurance, thrift and savings plans.

Production Control—the determination and regulation of the quantity of work to be produced through planning, scheduling and dispatching in order to prevent idleness of machines and workers to manufacture economically and deliver products when wanted.

Inspection—controlling the quality of work, preventing the shipment of defective goods, salvaging spoiled products.

Wage Control—the determination of base rates of pay, method of payment, standard tasks, performance requirements, salary classification to provide incentives to workers and establish wages and salaries fair to both employes and the company.

Shipping—the design and construction of packing containers, preparation of finished goods for shipment, loading of packed goods to insure safe delivery of products to customers.

Cost Keeping—the determination and allocation of the cost of manufacture including direct labor, material, indirect labor, supervisory, administrative and other fixed and variable expenses to furnish the management a record of production performance by which to improve and control operating conditions.

Budgeting—the predetermination and current recording of income and expense by departments or other functional divisions of the company to provide a means for executive action and control.

Traffic—determination of the most economical and satisfactory route and medium of transport for incoming and outgoing goods; the verification of freight charges; and the equalization of freight tariffs.

Plant Engineering—the economical production of heat and power; improving the character of illumination, ventilation and sanitation; the scientific selection, inspection and installation of machinery and equipment; the proper determination of feeds and speeds of machines; building construction and alteration.

Maintenance—upkeep, repair and cleaning of land, buildings, floors, machines and equipment to provide optimum operating conditions and to prevent undue depreciation and deterioration.

Research—the creation of new and the improvement of existing products, processes, methods and equipment to enable the company to maintain its competitive position, to raise the quality of the product and to reduce production costs.

Office Management—applying the same principles and practices used in the factory modified to suit office requirements, in order that the same degree of effectiveness of operation and control may be obtained.

Whereas all of the foregoing functions or phases are involved in industrial management, from an organization standpoint they find virtually as many treatments as there are industrial establishments. Depending upon size, products, personnel, policies, and personal ideas of executives, functions are variously grouped under individuals or departments and the emphasis on particular functions differs in intensity. Under any organization structure or arrangement, however, it is the responsibility and primary task of management to control these various functions and coördinate them into a smooth working unit. P. E. H.

BIBLIOGRAPHY.—D. S. Kimball, *Principles of Industrial Organization;* L. P. Alford, *Management's Handbook.*

INDUSTRIAL ORGANIZATION, the system by which capital and labor are brought into play to produce manufactured articles from raw materials and to place those products on the market. The first step in the organization of a typical modern industry is taken by a promoter who has a plan for producing a new product or for reorganizing an existing enterprise. The promoter presents his proposition to capitalists, and if they consider it sound, secures their backing. A corporation is then formed and securities are sold to the public. With the capital raised, investment is made in plant and equipment and a large portion is reserved for raw materials, advance pay roll and credit to customers. At this stage the great responsibility falls upon the general manager who must secure the proper plant and equipment and provide a sound efficient scheme of production, SCIENTIFIC MANAGEMENT being employed to this end. The labor for the plant is secured through an employment director or personnel manager who is also responsible for training the workers, providing safe, healthy, and desirable working conditions in the plant, and arranging a wage scale which conforms to local living conditions. When the finished products are produced the sales department must find a market for them and, conversely, the superintendent must arrange his production schedule to conform with the demands of the sales department. In all departments of industrial organizations accountants are employed to keep accurate and up to date records of all phases of the work. Most modern industries also have elaborately equipped research and testing departments to keep their products abreast of the times.

INDUSTRIAL PSYCHOLOGY, psychology applied to the adjustment of human behavior in industry. The two main divisions of industrial psychology are scientific management and vocational adjustment. The first is directed toward the proper adjustment of the worker to the methods and conditions of work. The second involves primarily the placement of individuals in the occupations for which they are best fitted. Properly speaking, there is no reason why the scope of this branch of psychology should not be broadened to include a consideration of the motives, incentives and interests of workers, as well as the more markedly social aspects of industry, such as the relationship between employer and employee and race problems.

Fatigue is of particular interest in industrial psychology because of the serious inroads it makes upon the worker's efficiency and the consequent loss in profits, health and morale. Industrial accidents have also been found to be more common during the hours of the day when fatigue is greatest. For instance, an investigation of accidents in the cotton industry in Lancashire, England, during the year 1908 showed the percentage to be least during the early hours of the morning and afternoon when the organism is least fatigued; from these points the curves rise steadily, reaching their peaks during the final hours of the morning and afternoon when fatigue is at its height. Various methods of combating fatigue have been devised. One of the best methods is the introduction of rest intervals at strategic points during the day's routine. Reducing the length of the working day has frequently brought about the two-fold result of decreasing fatigue and increasing production. Other methods are provided by mechanical devices for reducing the demands on the attentional powers of the worker and more efficient work methods.

Motion and Time Studies. Motion studies have as their aim "the improvement of those movements

of the worker that are necessary for the efficient execution of a given operation and the abolishment of those that are unnecessary." To aid in such studies an ingenious device, known as the chronocyclegraph, has been devised. With this instrument, which consists primarily of a small electric bulb attached to the moving portion of the worker's body and a camera for photographing the movements of this source of light, the course taken by the moving member in completing any given operation, as for instance chocolate dipping; the relative speed of different parts of the movement; the direction of the movement at any point in its course; and the time required for the movement can all be accurately determined. The startling results that may sometimes be effected through studies of this kind is illustrated by Gilbreth's study of bricklaying. After a careful analysis of the whole process of laying bricks, he was able to make recommendations which reduced the number of movements involved in the laying of a single brick from the traditional 18 to 5, with the result that by the new method 30 men were able to do as much work in a given time as 100 using the old method. Such studies do not necessarily involve the introduction of speedier and shorter movements into the operation, for such methods of speeding up often prove to be less efficient as well as more fatiguing. Thus long, sweeping movements have been found to be much less tiring than shorter and more abrupt ones. Neither does such experimentation hold to the assumption that there is one best method of work to which all workers must conform. The psychology of individual differences has adequately demonstrated the fallacy of this doctrine. It seems reasonable to suppose, however, that for any particular individual there is a most efficient method of executing any operation, and it is to the task of determining such individual standards that modern motion studies are quite largely devoted.

Motion studies are closely associated with time studies, for frequently their value can be stated only in terms of economy of time. Time studies are also valuable in setting the rate of speed at which an operation is to be carried out or in determining the most efficient rate of output. Rates of pay are frequently based on the results of time studies, although Link has suggested that studies of the more psychological factors of the task should supplement the time study in setting task rates. A consideration of such features quite often gives the lie to the idea that the speedy worker is the most efficient and most productive.

Careful consideration of the effect of the worker's physical environment upon the quality and quantity of his output has brought to light some interesting facts. Such factors as ventilation, illumination, temperature and humidity have all been found to exert a profound influence upon the kind and amount of work done. An example of the importance of such factors is the fact that "in the process of cotton weaving the use of good artificial light in place of daylight reduces output by 5 per cent, and in the more delicate processes of silk and fine linen weaving it reduces output by 10 and 11 per cent respectively."

Vocational Guidance and Selection. Fully as important as the determination of the best work methods is the selection of the best workmen. This task may be approached from either of two angles. We may take the individual and attempt to determine in which one of several occupations he is most apt to be successful, or we may begin with a specific job and select from a group those individuals that are best qualified. The former is known as VOCATIONAL GUIDANCE, the latter as vocational selection. The second approach has received more attention from industrial psychology than the first, because it is obviously better fitted to the needs of individual occupations.

The first step in any vocational selection project is to make an analysis of the capacities required for success in the occupation under consideration, either by determining the abilities of experts already engaged in the occupation or by making a careful analysis of the component elements of the job. The tests utilized may be of either the analytic or synthetic type. In the first, an attempt is made to analyze the job into its elementary components and test the applicant in each of the component skills thus revealed, while in the second, a test measuring the one principal capacity involved in the operation is utilized. Both types have been used with success, depending upon the complexity and nature of the job. This process of fitting the square peg into the square hole got its greatest impetus in the psychological service during the War. Since then it has been used most effectively in the rewriting of the manuals for training of men for the different war services and in vocational guidance and selection for these services.

Psychology also has a real contribution to make in the light it is able to shed upon the social aspects of industry. For example, an understanding of the psychological relations existing between labor and management is indispensable to any attempt to bring about a harmonious feeling between these two groups. Studies of the social feeling of workers toward each other and the psychological characteristics of trade unions and other federations of workers and financiers come within the scope of psychology, as does also the psychology of management, including a consideration of the psychological causes of discontent, restricted output, and other factors affecting the efficiency and happiness of workers. Race problems created by the concentration of foreign laborers in industrial centers furnish a fruitful field of study for the industrial psychologist. These, however, are principally fields of promise. Little has been done toward their development as yet.

Industrial psychology has made marked progress during the last two decades, particularly in Germany, England and America. It has been fostered mainly in three channels: the personnel services in the large industries, research in the larger universities dealing with the theory and technique of the problem, and the vocational guidance of all kinds in educational insti-

tutions. There are also institutes and boards devoting energies to some specific problem in industry. In recent years a new course in engineering called personnel engineering has come to the front.

P. Mu.

BIBLIOGRAPHY.—C. S. Myers, *Industrial Psychology in Great Britain;* H. Munsterberg, *Psychology and Industrial Efficiency;* B. Muscio, *Lectures on Industrial Psychology,* W. V. Bingham and M. Freyd, *Procedures in Employment Psychology;* H. E. Burtt, *Employment Psychology;* Moore and Hartmann, *Readings in Industrial Psychology.*

INDUSTRIAL RESEARCH, the utilization of scientific personnel and methods in the solution of technical problems arising in industry. In a thousand representative industrial companies, surveyed by the National Research Council in 1927, 31% of the research expenditures was used to reduce production costs; 34% to improve quality of product and service; 20% to develop new fields of application; and 15% to develop by-products and new materials. The average annual expenditure for research for the companies rated at $1,000,000 or more, according to this survey, was $45,000 or 1.3% of the invested capital.

The general use of industrial research dates from about 1890, one of the first laboratories in the United States being established by E. I. duPont deNemours Co. Industrial research in the United States was given considerable impetus by the World War. The National Research Council, organized for the solution of scientific and technical problems arising during the war was continued on a peace-time basis by an Executive Order of the President of the United States, and its Division of Engineering and Industrial Research is at present the national clearing house for industrial research activities.

The National Research Council survey of 1921 listed 575 industrial research laboratories; in 1927, a little over 1,000—or nearly 100% increase in seven years; and the survey in 1931 lists 1620 research laboratories as the present figure. It has been estimated that about 30,000 Scientists and Technologists are engaged in industrial research and that approximately $200,000,000 is spent annually by research agencies.

Four principal classifications of research agencies include laboratories attached to private industrial companies; to universities and technical colleges; to trade associations; and to government bureaus. One hundred and fifty technical colleges and universities are engaged in industrial research activities of a more fundamental or academic character of research. The place of the university in the industrial research scheme of things, is the training of personnel. The most significant trend in industrial research is a trade association activity. More than 100 associations are engaged in industrial research activities. M. Ho.

BIBLIOGRAPHY.—Maurice Holland, *Industrial Explorers,* 1929; *Tested Practice in Industrial Research,* 1931.

INDUSTRIAL REVOLUTION, the term applied to the change in the technique of industry, coupled with its general social and economic results, which occurred in the late 18th century. The phrase itself was popularized by Arnold Toynbee, but had been originated earlier by Friedrich Engels. It is not difficult to see how the development of large-scale production based on the use of power machines, with the resulting Standardization of goods in large quantities, came to be called a Revolution, especially as it occurred in a remarkably short space of time. Modern historians, however, are more prone to regard this economic process as an evolution, emphasizing its roots in 16th and 17th century commercial expansion and economic life, and its consequences in the 19th and even the 20th century. It therefore had none of the definiteness of time and effect which characterizes a political revolution.

England was the first nation to undergo the changes in economic and social structure resulting from the Industrial Revolution, which may be grouped under three heads:

Technical. Mechanical Inventions facilitated the spread of the Factory System and the development of large-scale production. Among the most important were textile machines (*see* Cotton and Cotton Manufacture), such as the fly-shuttle (John Kay, 1733), the spinning machine (Wyatt and Paul, 1738), the spinning-jenny (Hargreave, 1765), the water frame (Arkwright, 1787), the mule (Crompton, 1779), the power loom (Cartwright, 1785); the development of the steam engine to commercial success in James Watt's engine patented in its improved form in 1781; development of new processes in the iron and steel industry such as the use of coke for fuel, first successfully employed by Abraham Darby in 1718, puddling (Onions and Cort, 1783), the Bessemer steel process, and the like.

Industrial. The first to undergo the transition to modern industrial technique was the textile industry. The cotton manufacturers established factories and used machinery at an early date. The fly shuttle so quickened weaving that improvements in spinning became necessary to supply the yarn. By the end of the 18th century the cotton industry (*see* Cotton and Cotton Manufacture) was highly industrialized. The woolen industry (*see* Wool and Wool Manufacture) lagged behind, both because of its domination by centuries of tradition and also because wool fiber was less easily adapted to the use of the first crude machines. Equally important were the growth of the iron and steel industry and the perfection of the steam engine. First called into being in order to pump coal mines, the steam engine was important in providing power for the new machines, particularly in the iron industry, which, in turn, was enabled, by the development of new processes, to furnish the materials out of which the machines were made. Thus the revolution in technique spread from one branch of industry to another until nearly all were affected. The development of transportation was a necessary accompaniment.

Social. The growth of industry necessitated a large and centrally located labor supply. The new factories drew labor to them from the surrounding

countryside. In contrast to working independently in their own homes, with a chance to cultivate a plot of ground, laborers found themselves working long hours at factory routine. The early factory towns showed modern problems of housing and sanitation at their worst. It is a moot question as to whether the position of labor improved by this shift of population from agricultural and rural surroundings to industry under urban conditions. Some historians emphasize the evils of the new life. Others point out the greater flexibility as between classes, the better and more steady wages, and the higher standard of material comfort apparent even then in certain districts.

The Industrial Revolution spread in the 19th century from England to Europe and the United States. There was little real industrialization in France, but Germany became affected after 1840 and went through a period of rapid industrial expansion after 1871. The new industrial processes were transplanted full-grown into the United States in the late 18th century. The English prohibition against the exportation of machinery was of no avail. Machines were smuggled in and improved upon. Power was utilized earlier and more extensively, because of scarce and highly-paid labor and the availability of water power. Power transmission by gearing, which enabled several machines to be run from one shaft, was an American invention first used in flour mills.

Wherever the Industrial Revolution has taken root the same social and economic problems are apparent. Western civilization today is largely the result of the changes consequent upon the Industrial Revolution.

E. W. G.

BIBLIOGRAPHY.—P. Mantoux, *The Industrial Revolution in England;* H. U. Faulkner, *American Economic History.*

INDUSTRIAL WORKERS OF THE WORLD, a revolutionary labor organization launched in Chicago in 1905 as a merger of several radical unions. It has had a dramatic history. Its membership, never large, is shifting and unstable. It probably reached the peak of its strength at the time of the textile workers' strike in Lawrence, Mass., in 1912, when it may have had 100,000 members. Its membership in 1931 was probably less than 10,000. Its program rests upon the socialist doctrine of the class struggle and the necessity for the overthrow of the wage system. It insists that the immediate interests of workers should not blind them to their ultimate goal, and so trade agreements, sick benefits and even immediate improvements in wages and conditions are subordinated to the gospel of final emancipation. It has been less successful as a disciplined labor union than as a propaganda organization. In the latter rôle it has engaged in speech fights and strikes throughout the United States. These activities have borne little fruit so far as permanent organization is concerned. Its tactics have failed to lure the craft unionist away from his union or to effect permanent organization among unskilled workers in the unorganized trades. The only groups which the I.W.W. has been able successfully to organize are the casual, migratory workers. Its more important branches are made up of such workers in lumbering, construction, agriculture and the longshore and marine transport industries. During the World War its members took an aggressive antimilitarist position. The leaders and more active members were brought to trial in large numbers and about 150 of them were convicted and served long terms in Federal prisons. After the war more than a thousand of the I.W.W. were arrested and over 200 sent to prison under state criminal syndicalism laws, chiefly in California, Oregon, Washington and Idaho. Thousands of its members have been committed to local jails under city ordinances. Much of its energy has been expended in their legal defense, and in campaigns for their release. It is opposed to COMMUNISM and has refused to affiliate with the Third International. Among its leaders were Wm. D. Haywood, Vincent St. John and Wm. Z. Foster. The I.W.W. publishes two weekly papers in English and six foreign language papers.

P. F. B.

BIBLIOGRAPHY.—P. F. Brissenden, *History of the I.W.W.;* J. G. Brooks, *American Syndicalism.*

INDY, PAUL MARIE THÉODORE VINCENT D' (1851-1931), French music composer and teacher, was born at Paris, Mar. 27, 1851. After studying with Marmontel and Lavignac he worked for several years under CÉSAR FRANCK, and in 1873 was appointed professor of organ at the Paris Conservatoire, serving at St. Leu in the same capacity during 1872-76. In 1894 he aided in founding the Schola Cantorum in Paris, and in 1911 became its sole director, in which position his importance as a teacher became far-reaching. D'Indy appeared at intervals as guest conductor, visiting the United States in 1905. His scrupulous adherence to the principles of economy of expression made him an important figure in the modern French music of the classical school. His compositions include four symphonies, considerable chamber music, a collection of pianoforte pieces, the operas *Fervaal* and *L'étranger,* the cantata *Ste. Marie Magdalene,* the symphonic variations *Istar,* a number of songs and short choral works, the symphonic trilogy *Wallenstein,* the oratorio-opera-symphony *La Légende de St.-Christophe,* and the choral work *Le Chant de la Cloche.* D'Indy died at Paris, Dec. 2, 1931.

INERTIA, that property of matter which opposes any effort to set the body in motion when at rest and which opposes any effort to stop the body or change its direction once it is moving. Inertia is proportional to the amount of matter in a body. It may be said to be that property of matter which seeks to maintain its status quo in motion or at rest. This term is derived from a Greek word meaning laziness.

INFALLIBILITY, a word meaning freedom from liability to error and applied especially to the Pope. According to Catholic teaching, a general council of the whole Church (for instance, the Council of Nicæa, 325 A.D.) possessed a supreme authority to

pronounce upon doctrine. With the passage of time, the bishop of Rome claimed and was allowed a primacy in which authority tended to increase. In 1869-70, was held the Vatican Council at which were present about 600 bishops and other ecclesiastics. The dogma of papal infallibility was submitted to them and was approved by 535 votes. The dogma was then promulgated by Pope Pius IX. Its terms are carefully defined. The Pope is not held to be infallible in everything that, as an individual, he says or does. When, however, he speaks *ex cathedra*, i.e., from his pastoral throne, in order to "define doctrine with regard to faith and morals," he is declared to possess "that same infallibility with which the Divine Redeemer thought fit to endow the Church." A certain number of Roman Catholic divines of whom the most eminent was Johann Joseph Ignaz Döllinger, refused to acquiesce on the doctrine. Born at Bamberg in 1799 and dying in 1890, Döllinger, a professor of ecclesiastical history and law at Munich, was excommunicated in 1871 and summoned the conference out of which emerged a dissentient community known as the Old Catholics.

INFANCY, DISEASES OF. *See* CHILDREN, DISEASES OF.

INFANTILE ECZEMA. *See* ECZEMA.

INFANTILE PARALYSIS, or **ACUTE ANTERIOR POLIOMYELITIS,** an acute infection of the gray matter of the spinal cord, affecting especially young children. First described in the eighteenth century, this disease was recognized as an epidemic disease about 1890. It may be regarded as a general infection with a tendency to get into the nervous system where it attacks the gray cells in the anterior horns of the spinal cord either damaging or destroying them, thus causing a loss of power and wasting in the muscles supplied. The cause of the disease is an ultra-microscopic organism so small that it will pass through the pores of a porcelain filter.

The disease usually starts with a fever, which may last from one to five days. In this stage it is difficult to distinguish it from the onset of any acute infection. Sometimes the paralysis is the first thing noted.

There are various forms. There may be nothing but fever and mild symptoms (abortive cases); the common (spinal form) type is that in which the spinal cord cells are involved with a flaccid paralysis of one or more muscles or extremities. The paralysis usually comes on some time during the first week, occasionally later. In most cases it occurs on the second, third or fourth day. The extent of the paralysis is extremely variable both at the onset and later. Patients with extensive paralysis at first may show marked improvement, or the initial amount may be permanent. There may be or may not be pain. Later there may be deformities due to contractions of the muscles caused by paralysis.

Second attacks are rare, but have been reported. About 10% of the cases occur in adults.

The diagnosis is difficult before the paralysis comes on and a lumbar puncture (that is tapping the spinal canal) is of great value.

The younger the child, the better the chance for recovery. Under twelve the mortality is something over 10%—after that it is something under 30%. The mortality varies in different epidemics.

The treatment is most important. During the first 01 acute stage, the patient should be kept at rest and made comfortable. Splints or casts are often used to immobilize the parts and lessen pain, also to lessen deformities from contraction which may take place very quickly. Serum from convalescents or persons who have had the disease is often used if the diagnosis can be made before the paralysis sets in. Its efficacy has not been proven. Respiratory failure is best treated by placing the child in a Drinker respirator. (*See* ARTIFICIAL RESPIRATION.)

During the first six months, rest and prevention of deformity and muscle strain are most important; after the painful stage, light massage may be employed and later after from six to nine months, muscle training and exercise are begun. This must be done by experts and is best carried out in warm water. There are pools in many hospitals for this purpose and at Warm Springs, Georgia. The best results are obtained under competent supervision. Fatigue must be avoided.

While the greatest recovery takes place during the first two years of convalescence much can be done by training even later if there is any muscle function left.

J. R.

INFANTILE SCURVY. *See* CHILDREN, DISEASES OF.

INFANTRY, the branch of an ARMY organized and equipped to fight on foot. The word is derived from the Latin *infans* meaning infant, but why it was applied to foot soldiers is not clear. That it originated in feudal times when infantry was at its lowest ebb and foot soldiers were often boys who attended mounted knights, is one theory. Wars of the ancients were fought principally by infantry. The Greek phalanx and the Roman legion were infantry units. The success of these ancient battalions was due to organization based on definite tactical principles and to DISCIPLINE and MORALE, always sources of infantry strength. Infantry declined to the point of disuse during the feudal system. Mounted warfare was more to the liking of the feudal chiefs and lesser nobles who overran Europe and interest was lost in organizing the masses from which infantry is always drawn. The arm was revived in the warfare of the 14th century. At the Battle of Crecy in 1346 the organized and disciplined English archers contributed principally to the defeat of the French cavalry. Their deeds at Poitiers and Agincourt and the triumphs of the Swiss infantry at Morgarten, Granson and Morat reestablished the infantry as an arm. The principal infantry weapons at this time were the pike and the crossbow. Solid squares and heavy columns similar in most respects to the formations of the phalanx and the legion suited these weapons.

The introduction of firearms in warfare brought radical changes in infantry tactics. The old mass formations not only interfered with the full use of the new weapon, but they increased the deadliness of the enemy's fire. Shallower formations reduced the power of shock which was inherent in the old formation but this was compensated for by greater mobility enabling attacks against an enemy's weakest part to be substituted for the old direct attack. Each subsequent improvement in the rapidity of fire and range of firearms has enforced a reduction in the density of infantry battle formations. The infantry's offensive mission to seize physically the ground upon which the enemy attempts to resist can only be accomplished by first closing with the enemy. The problem of how to close with sufficient power to seize and hold has been made increasingly difficult by the growing fire power in the hands of the defender. Forced to reduce their losses from automatic weapons during the World War the Germans introduced infiltration (*see* TACTICS). By the end of the war all the armies were advancing their attacks by this process. The British contribution was TANKS. Their immunity to MACHINE GUN bullets enables them to close with the enemy, though their ability to seize and hold is questionable. Light machine guns adapted to the attack were also developed during the World War, to assist the infantry in advancing. Tendencies indicate that light machine guns will be the main arm of foot troops in the future and that armored vehicles capable of fast movement across country will be the principal means of advancing the infantry attack. E. D. P.

BIBLIOGRAPHY.—A. L. Wagner, *Organization and Tactics.*

INFANTS, NEW-BORN, CARE OF. *See* OBSTETRICS; MATERNAL AND INFANT WELFARE.

INFANT SCHOOLS, a term used to-day in Great Britain for schools for children ranging in age from five to eight. Kindergarten is the more general term in other countries. Infant schools date back to 1774 when the first was opened in France by Oberlin, a Lutheran minister. During the next 50 years infant schools were established in Great Britain, America, Belgium and Germany. In their early history, these schools cared for children of two to six from poor families.

See Salmon and Hindshaw, *Infant Schools, Their History,*

INFINITE, the unlimited and the unconditioned, that which is not finite; self-dependent and self-determining. The former conception represents the negative aspects of the infinite, the latter its more positive attributes. The infinite is both a philosophical and theological concept, and also has its place in mathematics.

The negative attributes of the infinite represent an attempt to think our way beyond a finite realm. From this standpoint as revealed in theology positive attributes would in some sense limit the deity, thereby making him finite rather than infinite. The unconditioned and unlimited and non-temporal attributes, though they tell little that is positive about the infinite, at least do not make it finite.

The self-dependent and self-determined attributes of the infinite represent the approach of absolute idealism. It attempts to think in more positive terms, at the same time allowing the infinite all the qualities due it. Perfection is one of these qualities, and from the theistic point of view so also are goodness, wisdom, justice and mercy. Through the attribute of perfection moral qualities are attributed to the infinite.

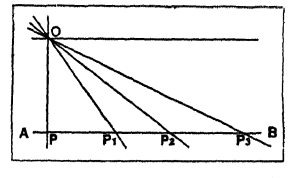
The idea of the infinite has not only played an important part in the conception of God, but has figured largely in thought dealing with time and space. ZENO used it in his paradoxes of motion and Kant in his antinomies. *See* ANTINOMY.

INFINITE SERIES, a series in which the number of terms is infinite. The sum may be finite, although the number of terms is not. For example, the sum of $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots$. n terms is 2 when n is infinite. The subject is discussed under SERIES.

INFINITESIMAL, an infinitely small quantity; one such that the difference between it and zero is smaller than any quantity that may be assigned; or the value of a quantity as it approaches indefinitely near zero. On account of the unsatisfactory nature of such definitions the term is decreasing in favor in mathematics, as in the name INFINITESIMAL CALCULUS. It is still used, however, in a sense quite different from the above, to mean a variable whose limit is zero, referring to Δy and Δx in the case of $\Delta y/\Delta x$ in speaking of the average change of y with respect to x in an interval Δx as this interval approaches zero.

INFINITESIMAL CALCULUS, a term formerly applied to the differential and integral calculus, the differentials being looked upon as infinitesimals. The name is still used, but not so generally. *See* CALCULUS.

INFINITY, in mathematics, a fiction invented for the purpose of preserving the uniformity of the system of certain mathematical truths and relationships. It is an abstraction based on the fact that in some cases the relations between certain elements within the finite domain lead to seeming contradictions if the finite domain is extended indefinitely, spatially considered. For example, if in the adjoining figure the line OP is rotated counterclockwise around the point O as a pivot, it can be observed that the point P will move to the right, and at the same time the angle OP_1P will decrease, and the angle POP_1 will increase. However, the intersection of the lines OP and AB will remain a physical reality until these lines become parallel. When they are parallel the lines seem to have no point of contact. To preserve the uniformity of the idea of intersection the fiction that the lines still intersect, even when they are parallel, is introduced, and the point of intersection is said to be at a point at infinity. Extending this notion it can be deduced that all parallel lines intersect at the same point at infinity, and that all the lines in a plane intersecting at infinity determine a line at infinity, and



finally that all the planes in space determine a plane at infinity. It is common to say that the RADIUS OF CURVATURE of a straight line is an infinite straight line, and a straight line is a circle with an infinite radius, i.e., with the center at infinity.

In mathematical reasoning it is of considerable importance to guard oneself and to use discretion when introducing the notion of infinity. Careless usage of this notion may lead to paradoxes, or inconsistencies, that are detectable only if it be understood that certain properties true for the finite domain are not true for the domain at infinity. For example, it would seem perfectly clear that in the natural unlimited number system there are fewer even numbers than even and odd together. However, this conclusion is erroneous. It can be seen that if we write the sequence of natural numbers, and under each number we write its double, we have the following sequences:

$S_1 = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, \ldots$
$S_2 = 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, \ldots$

For every number in S_1 there corresponds an even number in S_2, and however far this sequence may be written this will be the case. Hence S_1 represents the totality of all natural numbers, while S_2 represents the sequence of even numbers only, and this S_2 will contain just as many members as S_1; i.e., there are just as many even numbers as there are odd and even numbers taken together.

Another paradox may be illustrated in the problem of finding the sum of the infinite series

$$x = 1 - 2 + 4 - 8 + 16 - 32 + 64 - 128 + 256 - \ldots,$$

which may be written

$$x = 1 - 2(1 - 2 + 4 - 8 + 16 - 32 + 64 - 128 + \ldots) = 1 - 2x,$$

or $x = 1 - 2x$, or $3x = 1$, whence $x = \frac{1}{3}$.

But the above series can also be written as follows:

$$x = 1 + (-2 + 4) + (-8 + 16) + (-32 + 64) + \ldots$$

whence $x = 1 + 2 + 8 + 32 + 64 + \ldots$

which is a divergent series whose sum is infinite. Or it may be written

$$x = (1 - 2) + (4 - 8) + (16 - 32) + (64 - 128) + \ldots$$

whence $x = -1 - 4 - 16 - 64 - \ldots$

which will give an infinitely large negative sum.

The symbol for infinity, ∞, was invented by John Wallis (1616-1703). *See* SERIES; INFINITE SERIES; PROJECTIVE GEOMETRY. A. B.

INFLAMMATION, the reaction of the tissues of the body to an injurious agent which may be physical, chemical, or bacterial. In medical science the last named causative agent is the most important.

Microscopic study of living or fixed tissue demonstrates a series of events consequent on such injury. At first the caliber of the blood vessels increases and the blood flow is accelerated. The rate of flow soon slows up, but the vessels remain enlarged. At this time the white cells (*see* BLOOD) collect along the sides, while the red cells accumulate in the center. The white cells then migrate through the thin CAPILLARY walls, into the tissues. A considerable amount of blood plasma and a few red cells pass into the tissues also. The red cells disrupt and are absorbed by the lymphatics, but the white cells move about in the tissues by ameboid motion, having a preference for the site where the bacteria are most numerous. Here they may attack and ingest bacteria directly, or liberate antibodies which destroy the invading bacteria. A great number of the white cells die also and many cells of the surrounding tissue are killed by the toxins liberated by the bacteria. These dead cells of various sorts, together with exuded blood plasma, constitute pus.

The result of an inflammation depends upon its location, the nature of the causative organism, and the success of the defense. Generally some tissue is destroyed and repair occurs after either pus formation, ulceration, or necrosis. More highly specialized tissues are not rebuilt, but repair occurs through replacement by CONNECTIVE TISSUE formed by fibroblasts which migrate from the surrounding tissue to the scene of action.

The classic symptoms of inflammation are heat, pain, swelling, and redness. They were formulated by Celsus a short time after Christ. Heat is caused by the increased blood flow, pain by the irritation of the nerve terminals by bacterial toxins, swelling by the enlarged vessels and extravasated substances, and redness from the dilated vessels.

The prime principle in the treatment of inflammation is rest. The cause should be removed if possible and the comfort of the patient considered. An attempt should be made to increase the flow of blood, but congestion is to be avoided. A good circulation is especially valuable in the case of chronic inflammation, since its chronicity is generally due to an insufficient response of the tissues. An appropriate immune substance may be used for many bacterial diseases. *See also* ANTITOXIN; IMMUNITY; PATHOLOGY.

INFLATION AND DEFLATION. Inflation, in economics, is an expansion of the circulating medium in excess of the reasonable requirements of trade, resulting in a definite increase in the general level of prices. Conversely, deflation is a contraction of the circulating medium so as to hamper trade, resulting in a definite decline in the general price level. Inflation causes the buying power, or value in terms of all goods, of the MONEY unit to fall, while deflation causes the value of the money unit to rise. This definition of inflation and deflation does not depend for its validity upon the truth of the QUANTITY THEORY OF MONEY, although it is in harmony with that theory.

Inflation is generally caused by the overissue of paper CURRENCY, but marked inflation has also been brought about by extraordinary increases in the mone-

tary metals, GOLD and SILVER, in at least three historical epochs in modern times. A metallic inflation occurred during the first half of the 16th century, first in Spain, and later in western Europe following the conquest of Mexico and Peru with their treasures and mines of gold and silver. A gold inflation occurred in the middle of the 19th century due to the discovery of gold in California and Australia. Another gold inflation came at the end of the 19th century with the application of the cyanide process of gold extraction and the opening up of the extensive gold deposits of the Rand in South Africa.

But the printing press, not the mine, is the usual and most prolific source of inflation. A glance at a wholesale price index chart extending through the 19th century reveals that periods of greatest inflations are coincident with periods of major wars, which are the great producers of unsound finance and paper currency inflation.

Inflation raises prices and stimulates business. Wages rise, but nearly always more slowly than prices; workers lose in real income though their money wages increase, but employers as a class gain primarily because wages and other relatively fixed expenses lag behind prices of the goods they sell. Stockholders gain, while bondholders lose, because their incomes though fixed in terms of dollars, lose in purchasing power.

Deflation depresses prices, robs employers and profits the bondholders and other receivers of fixed money incomes. The losses of an employer will often lead to his shutting down his plant. So workers as a class lose because thousands are thrown out of jobs.

The most extreme example of inflation and deflation ever known was the post-war inflation in Germany of 1922 and 1923 followed by the collapse of 1924. At the end of Dec. 1923, the money circulation in Germany had reached the incredible total of 2,273,600,000,000,000,000,000 paper marks, about 37,500,000,000,000 per cent of the total circulation in 1913. The official wholesale price index for Dec. 1923, calling 1913 prices 100, was 126,160,000,000,000. The discrepancy between the increase in money in circulation and the price index is partly due to inaccuracies in the indexes of prices and money in circulation and partly to the decreased production and the increased velocity of circulation. I. F.

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INFLECTION, suffixing or prefixing certain elements either directly to some grade of the BASE or to a base extended by one or more determinants (*see* DETERMINANT), thus giving rise to the various cases, numbers and genders of nouns, adjectives and pronouns, or to the persons (*see* PERSONAL ENDINGS), numbers (genders), tenses, and voices of the verb. It seems best to restrict the term to those elements which, though indicating case, etc., have no known meaning in themselves; e.g., Latin *-orum* in *vir-orum,* "of men," is an inflectional element whose only connotation now is characterization of the "genitive" plural; but French *de l'homme,* "of the man," is not, since it comes directly from Latin *de,* and in itself means "from," VULGAR LATIN "of." The origin of inflection is much disputed, some holding that the elements were originally independent words which have suffered such attrition in the course of centuries that they have become unintelligible if isolated. In the present state of knowledge, no solution of the problem seems possible. That branch of LINGUISTICS concerned with the study of inflection is termed morphology.

INFLUENCE LINES. The calculation of the stresses in any BRIDGE structure may be accomplished by wholly analytical methods or by graphical processes wherein the scaled length of the lines of a diagram represent the stresses. When either method is tabulated for unit loads by the SANKEY-RITTER METHOD the theoretically exact tensile and compression stresses for each member are obtained. The influence line method is a semigraphic one, whereby the ordinates to a curve represent the values of a particular stress, such as the horizontal thrust in an arch. They are also useful for finding the position of the loads to produce maximum stresses in a member of a truss.

INFLUENZA, an acute infectious disease of unknown causation. A bacterium, named by Pfeiffer *Bacillus influenzæ* in 1892, was observed in the nasopharynx of a majority of patients. Though recent studies have confirmed this fact, the importance of this organism as the cause has been seriously questioned. A number of other bacteria, bacteria-like bodies, and a filter-passing virus have been more recently described as the actual cause.

Though cases of influenza are likely to develop at any time, its incidence is enormously increased by pandemics at variable intervals. The great epidemic of 1918, sweeping as it did over the entire world, causing over half a million deaths in the United States alone, and affecting from one-third to one-half the population in varying degrees, is especially to be recalled. The last previous large epidemic was in 1889. The characteristics of the disease varied in the two pandemics. The lungs were most especially attacked in the more recent outbreak, while the gastrointestinal tract and the nervous system were somewhat more frequently stricken in the previous one.

The disease has several forms. In the ordinary, uncomplicated case, after a symptomless incubation period of two days, an individual is rather suddenly siezed with a chill, fever, headache and backache. He takes to his bed and soon becomes extremely prostrated and weak. The temperature rapidly rises to about 104° F. and the pulse rate increases more slowly. There is loss of appetite. The face and extremities become quite purplish (cyanosis). The condition may be accompanied by mild delirium. The fever breaks almost as rapidly as it came on and convalescence is rapid, though recurrences are frequent if the convalescent leaves his bed too soon.

Influenza itself is rarely fatal, but it is very frequently complicated with bronchopneumonia. The symptoms of this outcome are cough, chest pain, and blood-stained sputum. Practically all patients dying as a result of influenza have had bronchopneumonia, so its absence is a good sign of a favorable outcome. In the latter days of the epidemic of 1918 there were many cases of pleurisy, recognized by pain in breathing; and of empyema, characterized by the accumulation of quantities of pus between the lungs and the chest wall.

In a few cases the presence of vomiting, abdominal pain, and diarrhea indicate the alimentary canal to be the chief seat of the disease. In other cases, the prominence of delirium, sleeplessness, and headache show that the nervous system is especially affected.

Influenza is almost certainly transmitted by droplet infection from sneezing and coughing, although experimental exposure to nasal mucous of infected patients failed to induce the disease. It seems likely that it is contagious only during its incubation period. Certain it is that isolation will prevent the occurrence of influenza in healthy persons, but this measure is not usually practicable.

Treatment is unsatisfactory, owing to the fact that no technique of immunization has been developed. Careful nursing, rest in bed, plenty of fresh air and wholesome food will help to maintain a barrier against complications. Rest during convalescence is especially important. *See also* COLD, COMMON. W. J. S. K.

INFRADYNE, a RADIO RECEIVER similar to a SUPERHETERODYNE, except that the summation BEAT note, instead of the difference beat note, is used. The amplifier of this CIRCUIT must be tuned to the summation FREQUENCY, which lies above that of the received signal (*see* ELECTROMAGNETIC WAVES) instead of between the signal and AUDIO FREQUENCIES.

INFRA-RED RADIATION: Therapeutic value of. *See* HELIOTHERAPY.

INFRINGEMENT, illegal marketing of a patented or copyrighted article of another, or of a trade mark. The subject is extremely technical, involving both law and facts. In patent law the device claimed as infringing must follow exactly the original patented article, otherwise the claim of infringement is not allowed or the arrangements of the machinery may differ, but if the similarity is fundamental, there is an infringement.

INFUSORIA, a name commonly given to an order (*Ciliata*) of Protozoa, because many of its members appear in vegetable infusions, especially in those which contain a little animal matter. Infusorians are the most highly of organized one-celled animals. Free-living forms are found abundantly in both salt and fresh water, and some species are parasitic on other animals. In form some are oblong; others are shaped like bells, trumpets or cigars. All possess cilia, tiny hair-like projections, with which they row themselves through the water. Infusoria differ from most other protozoa in having two sorts of nuclei, a macronucleus, concerned with the functions of the individual, and a micronucleus, active in conjugation. Typically, in conjugation, two individuals come together and exchange material from their micronuclei, and then separate. An infusorian ordinarily reproduces by dividing into two. Sometimes it forms a cyst, within which multiple division takes place. *See also* PARAMECIUM; STENTOR; VORTICELLA.

INGALLS, JOHN JAMES (1833-1900), American statesman, was born at Middleton, Mass., Dec. 29, 1833. Graduating from Williams College in 1855 he studied law for three years and then, drawn by powerful abolitionist convictions, went to Kansas to enter the Free Soil fight. He sat as a Republican in the State Constitutional Convention in 1859 and served as Secretary of the Territorial Council in 1860. He then definitely settled in Atchison, and in 1861 acted as Secretary of the State Senate. From 1863 to 1865 he edited the Atchison *Champion* and then returned to the practice of law until 1873 when he was elected to the United States Senate. He was twice reelected, acting as President *pro tempore* during his last term. Ingalls was a brilliant, forceful speaker and prolific writer on political subjects. His poem "Opportunity" is well known. He retired from politics and died at Las Vegas, N.M., Aug. 16, 1900.

INGALLS, MELVILLE EZRA (1842-1914), American railroad official, was born in Harrison, Me., Sept. 6, 1842, and educated at Bowdoin College and Harvard Law School. He gave up the practice of law in Boston in 1870 when he became president of the Indianapolis, Cincinnati & Lafayette Railway. Reorganized, this became the Cincinnati, Indianapolis, St. Louis & Chicago; later, after various mergers, Ingalls established the Cleveland, Cincinnati, Chicago and St. Louis Railway known as the Big Four System. He was chairman of this system until he resigned in 1912. He died July 11, 1914.

INGE, WILLIAM RALPH (1860-), English clergyman, dean of St. Paul's, London, was born at Crayke, Yorkshire, England, June 6, 1860. He was educated at Eton and King's College, Cambridge. From 1884 to 1888, he was assistant master at Eton, and for the following six years, tutor at Hertford College, Oxford. From 1905 to 1907, he was in London as vicar of All Saint's Church, Ennismore Gardens, when he was made professor of divinity at Cambridge. He became Dean of St. Paul's Cathedral in 1911. His originality and animadversions have caused him to be popularly known as "the Gloomy Dean." A prolific writer, he is best known for his works on Christian mysticism.

INGELOW, JEAN (1820-97), English poet, was born at Boston, Lincolnshire, Mar. 17, 1820. Her successful volume of *Poems,* published in 1863, first brought her into public notice. This includes the well-known poem, *High Tide on the Coast of Lincolnshire.* Her other works include several novels, a second volume of verse and some excellent stories for children. Among the novels is *Sarah de Beranger,* and among the stories for children *Mopsa the Fairy.* The author died at London, July 20, 1897.

INGENIEROS, JOSÉ (1877-), Argentinian physician, psychologist, author and sociologist. He was the founder of a school of criminology whose theories were opposed to those of Lombroso, and of the Institute of Criminology in Buenos Aires (1907). He has written extensively to propagate his ideas; his works fall into two groups, his earlier writings on mental pathology, and later ones on sociology and psychology. His chief works inclue *Simulacion de la locura* (1903); *Sociologia argentina* (1907); *Criminologia* (1908); and *La evolucion de las ideas argentinas* (1918).

INGERSOLL, ROBERT GREEN (1833-1899), American lecturer and lawyer, principally famous for his declarations of atheism, was born at Dresden, N.Y., Aug. 11, 1833. He was the son of a local Congregational minister and after a common school education he moved to Illinois where he studied law, was admitted to the bar, and began practice at Peoria. In 1861 he raised and commanded the 11th Illinois Cavalry, was captured in Dec. 1862, and after vainly waiting to be exchanged resigned in disgust. After the war he entered politics, serving as Attorney General of Illinois from 1867 to 1869 and presenting Blaine's name in an eloquent nominating speech at the Republican National Convention of 1876.

Ingersoll was an able orator and gained considerable political prominence, but he gradually became famous as an atheist, thereby ruining his political career. His atheism was largely of the naive "Why doesn't God strike me dead?" kind, but in a generation deeply imbued with the belief in the textual exactness and infallibility of the Bible, it won him a reputation as a brilliant but dangerous iconoclast. Ingersoll published his lectures and wrote a number of books attacking the Bible. He died at Dobbs Ferry, N.Y., July 21, 1899. In 1932 his remains were buried in Arlington National Cemetery, Washington.

INGERSOLL, ROBERT HAWLEY (1859-1928), American watch manufacturer, was born at Delta, Mich., Dec. 26, 1859. He had a common school education and, coming to New York in 1879, established a mail order business. In 1892 he originated the Ingersoll dollar watch and began manufacturing it. By 1919, 70,000,000 had been sold. Because of financial difficulties the company went into bankruptcy in 1921 and was taken over by the Waterbury Clock Company. Ingersoll retired at this time and died at Denver, Colo., Sept. 5, 1928.

INGERSOLL, an industrial town of Oxford Co., and a port of entry in Ontario, Canada, situated on the Thames River, about 102 mi. southwest of Toronto, and 19 mi. northeast of London. Farm produce of the district and the manufactures of local creameries, condensaries, cheese factories, cereal and flour, knitting and planing mills, and of engineering works, are extensively handled. Pop. 1921, 5,150; 1931, 5,235.

INGLE-NOOK (from the Scotch *ingle,* meaning fire or fireplace), a chimney-corner; one of the recesses created on each side of a projecting chimney. In furnishing a room, the ingle-nooks are often attractively utilized for ornamental seats, cabinets, bookcases, spinning wheels or the like. THOMAS SHERATON in his *Cabinet Dictionary* of 1802 recommends a buffet as "well suited to be placed on each side of the fireplace of a breakfast-room."

INGLEWOOD, a city in Los Angeles Co., southern California, situated 10 mi. southwest of Los Angeles; it is served by the Los Angeles Railway, and the Southern Pacific and Santa Fé railroads and by buses. The Los Angeles Airport adjoins the city. Inglewood has various manufactures, including furniture, metal products, airplanes and enamel ware. The retail trade in 1929 reached the sum of $8,567,455. It was incorporated in 1908, but the site was settled at an early date. The Old Adobe, once the ranch house of the Aguaje de la Centinela Rancho, built in 1786, is an interesting landmark. Pop. 1920, 3,286; 1930, 19,480.

INGOLDSBY, THOMAS. *See* BARHAM, RICHARD HARRIS.

INGOLSTADT, a Bavarian city and fortress on the Danube River about 43 mi. north of Munich. The principal buildings are the old and new castles, once the residences of the dukes of Bavaria-Ingolstadt, the ruins of a former Jesuit College, the rathaus and a theater. The college, founded in 1555, is the earliest center of Jesuit theology in Germany; it was moved to Munich in 1826. Locomotives, machinery and metal goods are the principal manufactures. There is considerable trade in grain, hops and wool. The city existed as early as 806. In 1632 Gustavus Adolphus besieged it in vain. The Austrians occupied the fortress twice and Moreau had it demolished in 1800, but it was rebuilt by Louis I. Pop. 1926, 27,840.

INGOTS, metal poured from a furnace (*see* OPEN HEARTH PROCESS) into a mold. They vary in size and shape, a common size for iron and steel being 2 ft. by 2 ft. by 6 ft., while gold and silver ingots are about 12 in. by ½ in. by 1 in.

INGRES, JEAN AUGUSTE DOMINIQUE (1780-1867), French painter of the Classic School, was born at Montauban, Aug. 29, 1780. He studied with Jacques Louis David and at Rome, but met with no success until the historical canvas, *Le Voeu de Louis XIII,* was exhibited in the Salon in 1824. Ingres founded a school in which he taught that "drawing is everything—color is nothing," a credo which may be taken as the key to his own art. The purity of his line and the surety of his draughtsmanship had a great influence upon such younger men as Degas, but his color was negligible. *La Source,* Ingres's most popular canvas, and the superb portrait of *M. Bertin* are both in the Louvre, Paris. The painter died at Paris, Jan. 17, 1867.

INHERITANCE, succession to rights and property of a deceased either by operations by law in the absence of a will or by virtue of a will. In the common law, only real property is inherited and that only in the absence of a will. Personal property passes to the executor or administrator and is distributed,

after payment of debts and legacies, to the next of kin. In the civil law the whole of the deceased's property and rights passes to an heir or heirs, fixed by law or appointed in a will subject to a duty of paying debts and legacies. Inheritance is now governed by statutes everywhere.

INHERITANCE TAX, a tax on the succession to the property of a deceased person. There are two principles underlying its justification; the "social," which advocates the discouragement of large fortunes; and the "fiscal," which is based on the theory of "ability to pay."

An outstanding characteristic of the modern inheritance tax is its susceptibility to graduation. Generally the tax is progressive in two ways: according to the size of the estate or inheritance, and in relation to the nearness of kin. Most inheritance tax laws exempt small estates or shares, and levy increasingly high rates on large ones. Likewise, widows and children of the deceased usually enjoy large exemptions and low rates, while the exemptions decrease and the rates increase as the relationship of the beneficiary to the deceased becomes more remote. In some cases the tax is levied on the estate, in others on the shares of the beneficiaries. Again, the tax may be levied according to the residence of the deceased or of the beneficiary or the location of the property involved. Since there is little uniformity in the basis of the tax in different jurisdictions, "double taxation" frequently results. T. N. B.

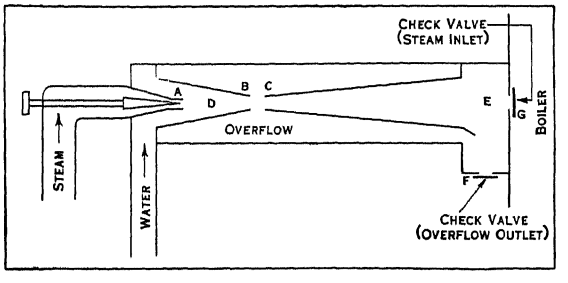
ININI, a French colony in the northern part of South America. Prior to June 6, 1930 the region was included in FRENCH GUIANA but by a decree on that date the interior portion of the colony was separated from French Guiana, placed under special administration and named the Territory of Inini. Guiana is now limited to a strip of coast land about 25 mi. in depth. The hinterland is a country of savannas and hills, rising in one place to an altitude of 2,624 ft. The climate is moist, foggy, unhealthy and unsuitable for white men. The temperature averages about 81° yearly. The soil is fertile and crops of sugar cane, rice, arrowroot, yams and bananas are grown by the inhabitants—Indians and Negroes. There are fine forests producing rosewood, balata and good cabinet timbers. Gold occurs in many parts of the colony and the output is valued at more than $1,000,000 yearly. Other known minerals are silver, copper, lead, tin, mercury, iron phosphates, iron, china clay, topaz and garnets. It is the intention of the French Government to colonize the country and develop its natural resources. Difficulties connected with transportation and labor have been the basic handicaps to progress in the past.

INITIATION. Initiation ceremonies are held by many primitive societies when a boy reaches puberty. Their purpose is to instruct the boy in the lore of the tribe and to make him eligible for full citizenship, sometimes for marriage. The ceremony may be performed for each boy separately or for groups of boys at stated intervals. The boys are secluded, sometimes for a short period, sometimes for months, during which they are instructed in tribal history and secrets. They may also have to fast or to undergo probationary ill treatment. Seclusion ends with an important ceremony at which the boy may be circumcised or may have to undergo an ordeal, such as whipping or having a tooth knocked out. Women are often excluded from this ceremony on pain of supernatural vengeance. Some tribes hold puberty ceremonies for girls, but they are not secret. There are secret societies for adults in many regions into which initiation is by an ordeal or an ordeal and a fee.

INITIATIVE, a modern political device by which the voters in a representative democracy may directly enact legislative proposal into law irrespective of the attitude of the legislature. The most common form of initiative requires the presentation to the secretary of state or other elected official of a petition or set of petitions signed by 15 or 20% of the voters of the state requesting that a specified measure be placed upon the ballot at the ensuing election. Upon the receipt of such a petition properly signed the measure must be placed upon the ballot. If at the ensuing election a majority of those voting upon the measure vote in the affirmative, the measure has been enacted into law. In a few jurisdictions a majority of all those voting at the election is required. The initiative was developed and has perhaps been used to its greatest extent in Switzerland. In 1898 South Dakota adopted both the initiative and the REFERENDUM, and since that date almost a majority of the states in the United States have adopted similar laws. S. C. W.

INJECTOR, a mechanism for forcing feedwater into a BOILER by means of steam which is taken from the boiler itself and, consequently, is at a pressure equal to that against which the water is being fed.

When the injector is in operation, the steam passes through the conical nozzle, A (*see* figure), which is



INJECTOR

surrounded by free water, the water either flowing to the injector not only by gravity but under forces generated by the "suction" of the steam passing through the nozzle. As the steam rushes through the second conical nozzle, B, it carries along a quantity of water, which surrounds the steam, and compresses and condenses it. As the water passes through the third conical nozzle, C, its velocity lessens, being resolved into pressure by the widening of the passage.

This pressure builds up until it is greater than that in the boiler, the check valve, G, then opening and admitting the water to the boiler. As soon as this happens an equilibrium of pressure is effected throughout the injector and a steady flow of water into the boiler continues. While the pressure is being built up in the injector, steam and water escape through the overflow valve, F.

INJUNCTION, an order of a court of equity directed to the defendant in a suit forbidding his owing of some act or acts complained of or directing him to restore the *statu quo* pending litigation. A mandatory injunction commands the doing of some affirmative act. Preliminary or temporary injunctions may be granted in order to preserve the *statu quo* pending omit. If the plaintiff prevails, the injunction will be made permanent or perpetual. Injunctions are the most effective remedy approved by the law and their use has been greatly extended in recent times.

INJUNCTION IN LABOR DISPUTES, a form of judicial remedy occasionally obtained by LABOR UNIONS, to enforce the performance of COLLECTIVE BARGAINING agreements, but the form which has given the injunction its great political significance since 1890 is its use by employers who invoke the injunction to stop illegal strikes and efforts of union leaders to organize nonunion employees.

The injunction takes three forms: 1. The temporary restraining order which is obtained on the mere filing of the bill of complaint without notice to the opposing side on the ground that irreparable damage might be inflicted before a hearing could be had. 2. The temporary injunction may be obtained after each side presents its case in the form of sworn written statements or AFFIDAVITS. The resulting decision is tentative, pending the final outcome of the litigation. 3. The permanent injunction which may be obtained after a full hearing. All facts are found by a judge without the aid of a jury and generally by means of affidavits rather than through oral testimony in open court subjected to cross-examination. Violation of the injunction is a CONTEMPT OF COURT triable by the same judge who issued the injunction, again acting without the aid of a jury, and the form and amount of punishment is generally within the court's discretion.

Labor injunctions have been seriously criticized partially on the ground that they are granted without adequate proof of the underlying facts and partially because they are said to invade the constitutional guarantees that speech, press and assembly shall be free from restraint other than the restraint inherent in legal liabilities for damage and criminal prosecution. Impartial investigators have pointed out that the labor injunction is vague and all-inclusive in form, that it sometimes paralyzes the exercise of indisputable rights of labor and sometimes it drives men to violence, but uniformly it inspires in large numbers of people disrespect for the judiciary. On the other hand it has been maintained that injunctions are necessary to prevent illegal damage to persons and property during a strike.

The United States and numerous state governments have enacted legislation restricting the use of the injunction in labor disputes. The Federal legislation which served as a model for state enactments is the CLAYTON ACT OF 1914. This regulated procedure narrowed the scope of permissible injunctive relief and provided for jury trial in all cases of contempt where the act complained of was independently a crime. This legislation, aside from the jury trial provision, was held by the Supreme Court of the United States to be merely declaratory of preexisting practice. As a result opposition to the injunction in labor disputes continued unabated and led to the passage on March 23, 1932 of a comprehensive Anti-Injunction Act. This withdraws from inferior federal courts power to enforce employee—non-union agreements (so-called yellow-dog contract) and to prevent conventional trade-union activities. It also provides procedural safeguards against erroneous findings of fact as well as against unjust convictions for contempt. In 1931 corresponding legislation was enacted *in toto* in Wisconsin and in part in Arizona, Ohio, Pennsylvania, Oregon and Colorado. N. G.

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INJURIOUS INSECTS. Insects which are harmful, directly or indirectly, to man, his household goods, his domesticated animals, his cultivated crops and his shade trees, or to forests, may be considered injurious insects. Some of these cause damage by eating leaves, roots, stems or fruits of plants. Others suck the juices of plants, or the blood of man and domesticated animals. Two types of mouthparts are recognized among insects. One type is fitted for chewing, the other type for piercing and sucking. In attempting the control of an injurious insect, it is necessary to know its method of feeding. To control insects with chewing mouthparts, poisons may be placed on food plants. Contact sprays, applied to the bodies of the insects, are used to control insects with sucking mouth-parts.

Some insects are directly injurious to man or domestic animals. Here may be included fleas, lice, botflies, flow-flies, warble-flies, biting flies, bedbugs. Others transmit disease while biting. Such are fleas, lice, some mosquitoes, and the tsetse fly. Still others carry disease germs on their bodies, which are brushed off on food. The housefly and cockroach are well-known examples. Of insects injurious to household goods, the clothes-moths, carpet-beetles and flour moths are probably best known. Ants, fish-moths and others may be occasional pests.

Many species of insects suck the juices of plants. Scale-bugs, aphis, and certain true bugs, are the most prominent offenders. Others, with chewing mouthparts, actually eat the substance of plants. Larvæ of many moths and some butterflies; many beetles, both larvæ and adults; and the maggots of certain flies, may be listed here. Many of these feed on the outside of the plant. Others live within its tissues, as borers or miners, or in galls.

The study of injurious insects, and methods for their control, constitute the subject of economic entomology. J. R. T.

INK, a substance used in the graphic arts for making characters on paper or similar material. There are two distinct kinds of inks, fluid and glutinous, the former being used for writing and drawing and the latter for printing. Fluid inks contain a pigment in suspension or solution. Ordinary black ink includes, essentially, tannin-yielding bodies, ferrous sulphate and a gummy medium. Some of the more brilliant inks are solutions of aniline dyestuffs in water. Metallic inks consist of finely divided particles of gold or silver, or imitation metals, in suspension. Synthetic inks, which are colorless until treated with a chemical reagent or with heat, cantain various colorless chemicals. Indelible ink, as India or drawing ink, contains lampblack as pigment. Printing inks are mixtures of pigment and varnish, the latter being prepared from linseed oil, rosin and soap. For lithographic printing inks see LITHOGRAPHY.

INKBERRY, the name given in the United States to a black-fruited species of holly (*Ilex glabra*), called also Appalachian tea. It is a small shrub with leathery evergreen leaves found chiefly in sandy soil near the coast from Nova Scotia to Florida and Louisiana. The name inkberry is applied also to the common pokeweed (*Phytolacca decandra*) and to the box-brier (*Randia aculeata*) of southern Florida.

INLAND EMPIRE, a name popularly applied to a rich agricultural, stock raising and mining region in the northwestern part of the United States situated between the Rocky and the Cascade mountains. The region which comprises most of the Columbia River plains, includes eastern Washington, northeastern Oregon, the panhandle region of northern Idaho and a small section of western Montana. Spokane, Wash., as the chief railroad and commercial center, is the capital of the empire. Wenatchee apples, famous for their fine color, come from the western part of this region and the Walla Walla Valley in southeastern Washington is a well-known fruit, grain, livestock and poultry district. Other important cities and towns are Pendleton, Ore.; Missoula and Kalispell, Mont., and Coeur d'Alene, Idaho. The soil is chiefly a decomposed basalt known as volcanic ash and is exceedingly productive. Irrigation is extensively practiced, the Great Bend region in the center of the district being naturally the driest area in the State of Washington.

INLAND WATER TRANSPORTATION, in contradistinction to land transportation by railroad and highway, ocean transportation both overseas and coastwise and AIR TRANSPORTATION, consists of transportation on lakes, rivers, bays, sounds, HARBORS, CANALS, etc., with the necessary packets, steamers, motorships, towboats, BARGES, canal boats, etc., and terminal facilities for the transfer of goods and passengers. The accompanying table gives statistics of the waterborne commerce of the U.S. Inland waterways are public ways as are highways, the carriers may be public, common, contract or private; and the terminals may be publicly or privately owned.

WATER-BORNE COMMERCE OF THE U.S.

(Report of Chief of Engrs., U.S. Army)

	1929	
	Short Tons	*Value*
Coast Ports		
Foreign Traffic	107,351,685	$ 8,561,334,624
Domestic Traffic	251,174,333	12,561,033,821
Great Lakes Ports		
Foreign Traffic	20,158,592	359,375,635
Domestic Traffic	141,185,669	2,017,476,851
Rivers and Canals	245,894,000	3,871,300,000
Adjusted total, foreign and domestic	583,000,000	$24,311,000,000

Prior to the railroad building era in United States the inland waterways were of relatively very great importance. However, with the practical completion of the railroad system in the latter half of the 19th century, the waterway traffic declined except on the Great Lakes System, due to its uncertainties and slowness and the approaching obsolescence of the canals together with the increasing efficiency of the railroads. On the Great Lakes a highly efficient system has been developed, particularly for the carrying of bulk materials such as ore, grain and coal. But in recent years, with the improvement of inland waterways and rapidly increasing freight traffic, the growing recognition of the economics possible in water transportation has given inland waterway transportation a new lease of life. Much, however, remains to be done in improving waterways, developing efficient transportation lines and terminals, developing a freight rate "structure" and coordinating waterways with the rest of the transportation system. Only then will inland waterway transportation approach its potential national value.

FREIGHT CARRIED ON INLAND WATERWAYS OF THE U.S., 1929

(Report of Chief of Engineers, U.S. Army.)

System	*Ton-Miles*
Atlantic Coast Rivers	1,343,198,863
Gulf Coast Rivers	475,569,107
Pacific Coast Rivers	776,745,040
Mississippi River system, including Ohio River and tributaries	4,982,630,693
Other Waterways	9,716,565
Canals and Connecting channels[1]	1,072,560,146
Great Lakes system[2]	97,322,360,000
Total	105,982,780,414

[1] Except Great Lakes.
[2] Omitting traffic between foreign ports on the Great Lakes.

Inland waterways are vital parts of the transportation system in many parts of the world. Natural waterways—such as the Rhine, Danube and Volga, and the improved and artificial waterways of Germany, France and Belgium—are highly important

routes for commerce. Properly developed and used, they are a great assistance to industry and agriculture.

F. R. H.

BIBLIOGRAPHY.—W. T. Jackman, *Economics of Transportation*, 1924; E. R. Johnson, *Ocean and Inland Water Transportation*, 1926; E. S. Clowes, *Shipways to the Sea*, 1929.

INLAY, decoration produced by setting into one substance another of different color or material; as ivory, shell, mother-of-pearl, metal or precious stones inlaid in wood, stone or metal. Inlay is used chiefly on furniture, walls, floors and jewelry. Niello, damascening, pietra dura, marquetry, parquetry and a certain type of mosaic all come under the general term inlay. It is an ancient art. Ulysses in *The Odyssey* tells Penelope of the bridal bed he has made, saying it is "fair with inlaid work of gold and of silver and of ivory." The TAJ MAHAL, erected in the 16th century, is an exquisite example of mosaic inlay of precious stones in white marble.

INMAN, HENRY (1801-46), American painter, was born at Utica, N.Y., Oct. 20, 1801. The family moved to New York where Inman studied drawing and worked with John Wesley Jarvis. His miniatures were considered second only to Malbone's, but the demand for his portraits in oil led him to relinquish this branch of work and in 1845 he went to England where his distinguished sitters included Wordsworth and Macaulay. Inman also painted landscapes and figure pieces with Shakespearian subjects, but he is best known for his portraits of such important Americans as John Marshall, De Witt Clinton, Audubon and Martin Van Buren. He was the first vice-president of the New York National Academy of Design and a director of the Pennsylvania Academy of Fine Arts. Inman died at New York City, Jan. 17, 1846.

IN MEMORIAM, a series of 131 poems by ALFRED TENNYSON, published in 1850, and written in memory of the poet's friend, Arthur Hallam. This elegiac series, written over a period of about 15 years, includes many of Tennyson's finest lyrical passages, and is noteworthy for its emotional sincerity, its numerous descriptions of nature, and for its expression of a noble religious faith.

INNATE IDEAS, a doctrine held by RENÉ DESCARTES (1596-1650), with whom it is usually identified. The theory holds that there are certain ideas so vouched for by the natural light of reason that they must be innate, i.e., inborn in the individual. Clearness and distinctness are the main properties of such ideas. The truth of innate ideas is intuitive; it is immediately perceived. Mathematical axioms illustrate such innate truths. For Descartes the idea of God was also innate. It was JOHN LOCKE who made the most thoroughgoing attack on the doctrine of innate ideas, and since his time the theory, in its original form, has not had good standing. The present emphasis upon native tendencies is the modern successor to the old doctrine of innate ideas.

INNESS, GEORGE (1825-94), American landscape painter, was born at Newburgh, N.Y., May 1, 1825. He began to draw at an early age and, although his father wished him to pursue a business career, he was apprenticed to a map-engraver at the age of 17. But his health was too delicate for such confining work and he began to study art under Regis Gignoux, a pupil of Delacroix. Through the generosity of a friend, Inness went abroad to spend 15 months in Rome. Later he passed a year in France, and there became attracted to the BARBIZON SCHOOL of painters, whose influence is evident in most of his work. When he returned to America his conception of landscape painting was something new. The HUDSON RIVER SCHOOL was dominant, but despite the sincerity of this group of men, it made small appeal to Inness with its niggling drawing and dull color. He had different ideas of interpreting nature. Like all innovators he made his way slowly but he proved his case finally and in consequence has been called the father of American landscape painting. His style changed with the years, grew broader and freer, with poetic envelopment and beautiful plays of light. The latter part of his life was his best period. He lived quietly at Montclair, N.J., industriously occupied. The most extensive public collection of his paintings is in the Art Institute, Chicago, among which are *The Storm, After a Summer Shower, The Catskill Mountains,* and *The Home of the Heron.* The Metropolitan Museum, New York, has Inness's *Autumn Oaks, Evening, Peace and Plenty, Delaware Valley, Evening at Medfield, Mass., Spring Blossoms* and *Coast Scene.* There are representative paintings by Inness in the art museums of several other American cities and in various private collections. While traveling for his health, the artist died at Bridge of Allan, Scotland, Aug. 3, 1894.

INNESS, GEORGE, JR. (1854-1926), American painter, was born in Paris, France, Jan. 5, 1854. He studied under his father, George Inness, in Rome and a year in Paris. He shared his father's New York studio in 1878. Later he had a studio in Paris. Inness devoted himself to animal painting and exhibited annually at the Paris Salon. He was a National Academician. His paintings include *Shepherd and Sheep,* in the Metropolitan Museum, New York, and *Monarch of the Farm, New Born Lamb, Maternity* and *Abandoned.* Inness died at Cragsmoor, N.Y., July 27, 1926.

INNOCENT, name of 13 popes and an antipope. St. Innocent I, 401-417, strove to extend the papal primacy beyond Italy and combatted heresy. Innocent II, 1130-43, was elected Pope by some of the cardinals, but was driven from Rome. Bernard of Clairvaux secured support from the foremost sovereigns and he was reinstated. His was a tumultuous reign. Innocent III, 1179-80, was set up as third antipope to Alexander III in 1179, but was imprisoned and banished by Alexander in 1180. Innocent III, 1198-1216, a very able prince of the Church, who conceived his rulership as a mission to rule the whole world. The confusion of the times aided him in reassembling the Papal States. His powerful hand fell upon the emperors and the kings of France, Léon and Denmark,

who obeyed his behests. His ward, Frederick II, whom he crowned, obtained his recognition as King in Germany, but he mourned over the result of the Fourth Crusade, from which he hoped to reunite the Eastern and Western churches. He was one of the greatest of the popes. Innocent IV, 1243-54, though previously friendly with Emperor Frederick II, was forced by him into a bitter feud, which was handed down to his son and heir, Conrad IV. After the death of the latter, the Pope attempted to secure his lands in Italy, but soon died. He was a great scholar. Blessed Innocent V, 1276, an able French Dominican monk, was made Pope in 1276, but died within five months. Innocent VI, 1352-62, a French Pope, who resided in Avignon. He attempted to reform the curia and save money. Innocent VII, 1404-06, elected by the Italian cardinals and unable to end the Great Western Schism. Innocent VIII, 1484-92, before his election was a rival of Alexander VI in public and private perfidy and vice. Innocent IX, 1591, elected 1591, but died two months later. Innocent X, 1644-55, was largely in the hands of his scheming and venal sister-in-law. Innocent XI, 1676-89, a zealous and able reformer, administrator and statesman, who was involved in a long struggle with Louis XIV of France. Innocent XII, 1691-1700, settled the quarrel with France by obtaining concessions. Innocent XIII, 1721-24, engaged in Italian politics and was a strong opponent of the Jesuits on the question of the Chinese rites.

H. K. Mann, *Lives of the Popes in the Early Middle Ages,* 1902; H. Grisar, *History of Rome and the Popes of the Middle Ages,* 1911; L. Pastor, *History of the Popes from the Close of the Middle Ages,* 1898.

INNOCENTS ABROAD, THE, "or The New Pilgrim's Progress," an extravagant parody on the sentimental traveler, by Mark Twain (*see* S. L. CLEMENS); published 1869. This broadly satirical travel book has for its chief characters a group of "innocent" Yankees who, posing as the rawest Philistines, get into numerous comic adventures during their tour of Europe and make many droll comments on works of art and antiquity. This was Mark Twain's first successful book.

INNSBRUCK, capital of TYROL, Austria, since 1420, situated on both sides of the Inn River among the Alps. The court church built in the Renaissance style, about the middle of the 16th century, is the most imposing edifice of the city and contains the tomb of Maximilian I, "the Last of the Knights," with 28 statues of famous princes and princesses, although he himself is not buried there. There are many other interesting churches and palaces. Among the ten cloisters is the oldest German Capuchin monastery. There is a university, founded in 1673, and other educational institutions. The principal industries are woolen, cotton and linen goods, and metal products. Innsbruck enjoys a heavy tourist traffic. Pop. 1923, 56,401.

INNS OF COURT AND CHANCERY, certain unincorporated societies of English lawyers. They originated about the beginning of the fourteenth century. Students voluntarily collected at these inns to hear lectures on law, and to study. Two of the surviving Inns belonged originally to the Knights Templars, and are called Inner Temple and Middle Temple. Lincoln's Inn and Gray's Inn were originally houses of noblemen. There were Inns which have ceased to exist. The four Inns named have exclusive control of the training and admission to practise of banisters and immediate control over professional conduct of the higher branch of the legal profession.

INOUYE, JUNOSUKE (1869-1932), Japanese financial leader, was born in Oita. He entered the banking field immediately after graduation from the Tokyo Imperial University in 1895, and was the London agent of the Bank of Japan from 1908-11 when he became vice-president, 1911-13, and then president, 1913-19, of the Yokohama Specie Bank. He was governor of the Bank of Japan in 1924 and again in 1927-28, and Minister of Finance in 1924 and from July 1929 to Dec. 1931. Inouye was shot and killed Feb. 9, 1932, as he was about to address a political meeting.

INQUISITION, THE. The name is from *inquisitio,* a common form of judicial procedure. It has come, however, to designate a court of special jurisdiction, called into being by the papacy in the early part of the 13th century to cope with heresy, which was then rapidly increasing. The heretics of the 12th and 13th centuries, divided into numerous groups chief of which were the CATHARS or Albigenses and the WALDENSES, attacked quite as much the organization and personnel of the Church as its doctrine. Growing urbanization, shifting social relationships, political and economic unrest, combined with more purely religious motives to induce this attack upon constituted authority as represented in the Church. During the 12th century leaders of the Church were well aware of the danger. They tried to meet it by preaching and instruction, and through the normal diocesan jurisdiction. The bishops were unable to cope with the situation. Before the close of the century princes were enjoined to aid the ecclesiastical authorities in rooting out heresy. In the beginning of the following century a papal legate was sent to southern France, where heresy was most widespread, in the attempt to eradicate it. The legate was murdered, whereupon a crusade was proclaimed against the heretics and their supporters, and Languedoc subsequently was ravaged with fire and sword by the crusaders.

To ecclesiastical censure was added the proscriptions of the temporal power. There were several decrees of banishment for heresy during the later 12th century, and in 1197 the King of Aragon added the threat of death for those heretics who failed to leave his kingdom. Some 25 years later, 1220, Frederick II proclaimed the death penalty for heresy in his south Italian lands, a decree which he shortly made operative for the whole Empire. Other states followed suit.

Church and State were united to root out the heretic who was looked upon as endangering civil as well as ecclesiastical authority, and subverting the existing social order.

Special Courts Established. This was the situation which confronted Pope Gregory IX. About 1230 he issued a series of letters creating courts of extraordinary jurisdiction to deal with heresy. These courts he placed in the hands of the new orders of Friars, Dominican and, later, Franciscan. Inquisitors were given authority to conduct trials for heresy in specified regions, Languedoc, France outside of Languedoc, Germany, etc. The local clergy were instructed to assist them.

Inquisitors traveled frequently in pairs. After a period of grace, during which inhabitants of a certain region were given opportunity freely to come forward and confess heresy or commerce with heretics, they called suspects before them, examined them under oath, and heard depositions against them. The inquisitor was at once prosecuting attorney and judge. To testify in favor of the accused or to appear in his defense laid the individual open to the charge of aiding heretics. It was difficult, therefore, to secure a really fair hearing. The aim of the court was to secure a confession from the accused. To this end TORTURE, not unknown but sparingly used in legal processes during the preceding period, came to be employed as a regular form of procedure. By the end of the 13th century it became common practice to call to the aid of the inquisitors a body of experts (*jurisperiti*), both lay and clerical, before whom testimony was laid and who gave advisory opinions regarding the proper disposition of cases that had been thus presented to them.

Within the purview of the inquisitorial courts came cases of heresy, witchcraft, sorcery and even at times usury. But the inquisitor was not supposed to have jurisdiction over anyone outside of the Christian faith. Jews and Moriscos were brought before the court in large numbers, but, except for possible cases of irregularity, it was only as nominal Christians that they were subjected to persecution at the hands of the inquisition.

Range of Penalties. Judgments of the Inquisition included a wide range of penalties. For the penitent heretic or follower of heretics punishment consisted more commonly in fasting, flagellation, the wearing of a distinctive mark, pilgrimages, fines and imprisonment for a definite period or for life. Sentences were severe; but commutation, at least in the earlier period of the institution, seems to have been fairly common. For the impenitent heretic, or one who had been won back from heresy to orthodoxy and then again "relapsed" into heresy, was reserved the extreme penalty. His property was confiscated, and he might be imprisoned for life, in chains and on bread and water, or he might be turned over ("relaxed") to the secular arm to suffer the penalty of death by burning. The earliest inquisitorial records for Languedoc appear to know nothing of the death penalty for heresy. Relapsed heretics were condemned to life imprisonment. The death penalty for the obdurate heretic was not long in coming, but it was not until the period of the Spanish Inquisition in the late 15th and 16th centuries that wholesale burnings occurred. From the testimony of the sentences of Bernard Gui, one of the ablest and most active inquisitors in southern France in the early 14th century, it appears that during the period of 16 years that he was inquisitor he turned over to the state for execution only approximately 60 heretics.

The pronouncement of sentence upon a group of those convicted constituted a solemn ceremony, the *auto da fé,* before as large a gathering as possible, in order to impress the inhabitants of the region. A sermon was preached, sentence was pronounced, and those who were to suffer the extreme penalty were turned over to the secular power to be led outside the town and burned. In connection with this latter it has sometimes been pointed out that the Church may not be charged with the death of heretics and that, on the contrary, the inquisitor in handing over the heretic prayed the prince to be merciful. The question is academic. Both Church and State shared responsibility for the death of the heretic and had no hesitation in accepting that responsibility, though technically the Church might not be guilty of blood. Excommunication was threatened any prince who failed to exact the due penalty of a person convicted by the court.

Confiscation constituted one of the most serious defects in the procedure of the Inquisition. Sometimes profits of this went to the state, sometimes they were divided between the clergy and the secular government. The powerful motive of cupidity was thereby added to influence convictions. We find French officials in the late 13th century complaining, for example, that the inquisitors are too lenient, to the damage of the royal fisc. And there are cases on record where the spoils were divided before even the accused was brought to trial.

The Inquisition found its way into practically all of central and southern Europe. It got a partial foothold in England only for a moment early in the 14th century when inquisitors sat there in the case of the Templars. During the latter part of the 14th and much of the 15th centuries the fear of heresy was on the wane and the activities of the Inquisition greatly decreased. Toward the end of the 15th century, however, it was revived again with great bitterness in Spanish lands. Under Torquemada in the late 15th century it became a terrible engine for the rooting out of heretics, Jews and Moriscos from Spanish territories and for the establishment of absolutism in Spain and its dependencies. Thus it found its way over seas, in the new colonial empire established by Spain. But the end of the 16th century saw its activity greatly curtailed. It lived on even into the 19th century, and there were some striking cases of its activity. But the battle between obedience and non-conformity came to be fought largely on other

grounds and with other weapons. There is still a Congregation of the Inquisition in the Papal Curia.

A. P. E.

BIBLIOGRAPHY.—H. C. Lea, *A History of the Inquisition of the Middle Ages,* 1888; *A History of the Inquisition in Spain,* 1906-07; *A History of the Inquisition in the Spanish Dependencies,* 1908. These three works constitute the most exhaustive synthetic treatment of the subject, although Catholic historical scholars differ with Lea on the interpretation of important documents in his massive collections. For brief but careful sketches *see* E. Vacandard, *The Inquisition,* 1908, translated from the French by B. L. Conway, and A. S. Turberville, *Medieval Heresy and the Inquisition,* 1920. The former is from the pen of a Catholic scholar.

INSANITY. Insanity, treated from the point of view of mysticism, fanaticism, and religion during the Middle Ages and in antiquity, has come to be synonymous to mental disease. The branch of medicine which confines itself to the diagnosis and treatment of insanity is called PSYCHIATRY. The early psychiatrist attempted to define mental disease on the basis of organic changes in the brain. Towards the end of the nineteenth century a new school developed which endeavored to explain certain mental diseases in term of a disfunction of the entire personality. This more modern conception interprets many psychoses in terms of psychogenic mechanisms; that is, disorders resulting from internal conflicts.

Generally speaking, abnormal mental states are divided into dementias, feeble-mindedness, psychoses, and neuroses. The neuroses are, however, not insanities. The *dementias* are, for the most part, due to a deterioration of the brain tissues. They are characterized by a loss of former intellect, with a resultant lack of memory, judgment and retention. The main groups of dementias are senile dementia, arteriosclerotic dementia, dementia due to syphilis of the central nervous system, and other organic brain diseases resulting from brain tumors, injuries, etc. Insanity, with general paralysis, is the most common and important result of syphilis of the central nervous system. This disease causes about 15% of all the insanity. Though it may produce temporary psychoses, it terminates in a deep and lasting dementia.

Mental deficiency is a defect in the development of a patient's intellect. It originates from childhood. Usually this is demonstrated by an abnormally slow intellectual development and mental retardation which becomes especially evident when the individual enters school. The mentally deficient are divided into three great divisions, according to their degree of intelligence, idiots, imbeciles and morons.

The *psychoses* need not necessarily show any intellectual defect, but do show a faulty arrangement of the internal symbolism and mechanism of the mind, together with faulty or distorted apperception and sequence of thought. The main psychoses are manic depressive insanity, schizophrenia (or as this group was formerly called, DEMENTIA PRAECOX), epileptic psychoses, toxic exhaustive psychoses, and alcoholic psychoses. The first two are generally supposed to be psychogenic, or to originate from unknown causes, while the others are due to diseases or poisons. The characteristics of manic depressive insanity, as opposed to schizophrenia, are an inclination for this disease to recur at frequent intervals with interims of comparative well-being and mental health, while schizophrenia can end in an absolute destructive introversion of the entire mental organization, unless this progressive trend is arrested. The outcome of toxic psychoses depends upon the extent and duration of the poisonous influences. After the elimination of these factors, the patient usually recovers. Should the toxic state continue over a long period, these patients are inclined to continue demented, since a permanent injury of the brain tissues results. This is especially true of chronic alcoholic states.

The legal attitude towards mental disease has little in common with the medical classification. It is generally synonymous with the idea of *non compos mentis.* In order to be legally insane, most states demand that the person be incapable of knowing the quality of the act or that the act which he committed was wrong. A few states admit that a patient is insane if he is under an irresistible impulse to commit a certain act. The question of legal insanity is generally broached in murder trials, in contested wills, etc. The laws governing the simple commitment of a patient to a mental hospital are now liberal, and are generally based upon the findings of a medical commission. Whenever there is "battle of experts" it is usually due to a purely legal attitude and the legal interpretation of the actual medical findings. The courts usually demand that the psychiatrists interpret their findings into states of responsibility instead of allowing this to be done by the jury or court. *See also* FEEBLE-MINDEDNESS; PSYCHIATRY.

C. A. N.

Statistics. On Jan. 1, 1923, there were 267,617 patients confined in 526 hospitals in the United States. Approximately one out of every 400 persons in the total population, or about one out of every 270 persons 15 years of age and over, was included. Moreover, only the more serious cases of mental disease, those classified as the psychoses, are commonly placed in hospitals, while the psychoneuroses and neuroses do not ordinarily have institutional care. Thus the data understate the actual number of cases of insanity.

In 1917 a standard classification of mental disorders was developed by the National Committee for Mental Hygiene and the American Psychiatric Association. This classification is the one in general use by all up-to-date hospitals.

Statistics on mental disease are usually stated in terms of total admissions. A more accurate statement is in terms of first admissions, meaning those persons who enter a hospital for the insane for the first time within a given year. This supplies a more accurate measure of the actual number of persons in the population who are becoming insane each year. The following statements are based on analysis of hospital data, the only adequate basis for conclusions with regard to the prevalence of insanity in the United States. Such data are unavailable for other countries,

Insanity increases with advancing age. Below 15 years of age there is very little insanity. The highest rates are found in the oldest age groups. Each type of mental disease has a characteristic age distribution. Dementia praecox, manic-depressive psychoses, and the psychoneuroses and neuroses tend to occur rather early in life. General paralysis, chiefly syphilitic in origin, and alcoholic psychoses are important in middle age. Senile psychoses and cerebral arteriosclerosis are characteristic of old age. Due to the close relationship with age, it is evident that the gradual aging of the total population in the United States will result in a higher rate of insanity.

There are more male first admissions to hospitals for mental disease than female first admissions. On the other hand there is a more pronounced tendency to care for female patients in private hospitals than is the case with males. The difference in numbers by sex is due primarily to the greater prevalence of alcoholism and syphilitic infection among men than among women. When this is accounted for, the rates of first admissions are much the same. Even so there are significant sex differences in the distribution of psychoses, males, for example, having higher rates of dementia praecox, females of manic-depressive psychoses. Married persons, both male and female, have lower rates of mental disease than do the single, widowed or divorced. Single males have higher rates of mental disease than do single females but it is also true that abnormal behavior tendencies probably operate more strongly to prevent marriage in the case of males than in the case of females.

Insanity has long been recognized as one of the factors in crime but as yet there has been little adequate research in this field. It does appear that the rate of mental disease among criminals is significantly higher than the rate for the general population. Insanity is an important source of delinquency due chiefly to the seriousness of the crimes committed rather than because of the number, the percentage of crimes against the person tending to be high. Furthermore, insane criminals appear to have an abnormally high rate of recidivism. Both hospital accommodations and the total number of insane patients in hospitals have been increasing rapidly. While the usual opinion is that insanity is on the increase, careful analysis of the existing data reveals the fact that there is no general tendency toward an increase in the actual rate of insanity. The trends of the numerically more important types of insanity, such as manic-depressive psychoses and dementia praecox, have been practically stationary for some years. General paralysis is decreasing in importance while alcoholic psychoses after a spectacular decline during the World War period are again increasing.

In modern times a new orientation in attacking the problem of mental abnormality has been achieved. Whereas in the past attention was chiefly directed toward the psychological aspects of insanity, the social connotations are beginning to secure recognition from an ever-widening public. Evidences of this are the improved facilities for the institutional care of the insane and the emphasis both on preventive work and the readjustment in society of those persons who have experienced temporary cases of mental disease.

E. W.

INSCRIPTIONS, records incised on imperishable materials such as stone, marble, metal, etc., usually set up, with the exception of sepulchral inscriptions, in conspicuous places for the purpose of public information, found in some form or other wherever civilization has flourished, and constituting a highly valuable source for study of the scripts, languages, customs, laws and religions of ancient times. Inscriptions vary widely in material, script, style, size, content and place of exhibition. Thus an inscription set up by a king commemorating a victory is written in heavy and cumbersome verbiage, while codes of law are couched in short and precise diction. The earliest inscriptions, dating from about 4000 B.C., are found in Egypt and southern Mesopotamia, but the first known epigraphic record in an ALPHABET is the Moabite Stone of the 9th century B.C. The oldest Greek inscriptions go back to the 8th or possibly the 9th century B.C., Roman to the 6th century B.C., and Indian to the 3rd century B.C., while inscriptions found in Mexico and Central America are probably not earlier than 100 B.C.

INSECT BITES AND STINGS. Not only are various diseases transmitted by the bites of insects, but in addition the bites of some insects cause local irritation of the skin. While a single bite usually does not cause any general symptoms, multiple bites may cause a severe reaction. The fact that disease may be transmitted through the bites of insects was demonstrated in 1892 by Theobald Smith. Mosquitoes, flies, ticks, bedbugs, lice and fleas all transmit diseases through their bites.

The *bedbug* punctures the skin to suck blood. To promote the flow of blood, the insect injects an irritating substance. This causes a red swelling at the site of the bite. The swelling disappears in a few days in most instances. As a result of scratching, due to the itching of the bite, infection may occur. There are no general symptoms. The bites may be treated with an alkaline lotion or baking soda paste, or with a lotion containing carbolic acid.

Flea bites cause a similar reaction of the skin, and the treatment is about the same. Multiple flea bites in some individuals may cause fever and other symptoms of poisoning. Some persons apparently are insensitive to various types of insect bites and in these persons there is neither a general nor local reaction to the bite.

The *body louse,* which is larger than the head louse, may cause irritation of the skin, leading to the formation of boils or abscesses. (*See* PEDICULOSIS.)

The bites of *gnats, flies* and *mosquitoes* cause about the same local reaction as do bedbug bites. Small, white swellings are produced that itch markedly. Later these swellings become red in color.

Bees, wasps, ants, and *caterpillars* also may injure

the skin to a greater or less degree. Bees and wasps produce injury by their stings. If the stings are very numerous, there may be serious general symptoms, such as fever and great prostration and even death may result.

Some *spider bites* may be extremely poisonous.

In the case of stings, applications of spirits of camphor or diluted ammonia water or menthol are useful in the treatment.

The diseases transmitted by the bites of mosquitoes are malaria, yellow fever, and dengue. The bites of flies produce various tropical diseases, such as African sleeping sickness and deer-fly fever. Bedbugs are carriers of European relapsing fever and Indian kala-azar. Louse bites produce relapsing fever, typhus fever and trench fever, while flea bites are responsible for plague and kala-azar.

Individuals who are constantly exposed to insect-bites may sometimes protect themselves by covering the skin with oil of eucalyptus or tar oil. There are a number of substances that may be used in destroying insects. These include sulphur, formaldehyde, petroleum and hydrocyanic acid gas, the latter, however, being very poisonous to the human being. *See also* ENTOMOLOGY, MEDICAL: Parasitic Diseases.

W. I. F.

INSECTICIDES. Man-applied materials used to kill insects, may be classified according to the ways the insects feed and according to the animals or plants they prey upon. Insect parasites on man are killed mostly by greases and oils, though eggs of crab and body lice in clothing are destroyed only by hard boiling. Fleas on pet animals are fought with carbolic soap; lice on hens and other land birds by fine dust which clogs the breathing system. The addition of tobacco dust enhances efficacy. Poultry mites, which are not insects, are killed by kerosene sprayed or swabbed in cracks, nests and on roosts where the creatures spend the day. Tobacco extract, various dips and greases will rid sheep and hogs of external insect parasites, and weekly currying with brushes dipped in kerosene emulsion, diluted six times with water, will rid horses of similar pests (*see also* HORSE BOT-FLY).

Clothes moths and granary insects are destroyed by heat or by suffocation with carbon disulphide or hydrocyanic acid gas. In a small way the infected articles may be placed in air-tight containers; on a large scale whole buildings may be fumigated. As the former is highly inflammable and explosive, no spark or light must come near it; and as the latter is violently poisonous it must be used with extreme caution.

Most insecticides, like fungicides, may be applied in liquid or dust form. They are used to destroy insects on plants and may be classified according to the ways that the creatures feed, either by biting off and swallowing plant tissues or by sucking the juices. Chewing insects are of two classes, those that live wholly beneath the surface of the ground or the plants and those that feed upon the surface. Of these the first include wireworms, which feed on grass roots, leaf miners in the green tissues and borers in wood. These cannot be controlled by sprays because they are protected by the soil or the plant tissues in which they work. Several species of borers, however, may be destroyed by poisonous gases generated by calcium carbide or paradichlorobenzine placed close to but not touching the tree trunks and buried with earth. The moisture of the ground acts on the materials and sets free stifling gases.

Chewing insects that feed on the foliage are readily destroyed by poisons that act through the alimentary canals of the insects which swallow them. These include the larvæ of many flies, moths and butterflies and both nymphs and adults of grasshoppers, crickets and beetles. Insects that suck juices include many of the worst plant pests. They cannot be killed by stomach poisons because their food is sucked from beneath the surface, and some resist every material which may be used without damage to plants. The most effective controls of sucking insects include various dusts, oils and caustics which either clog the breathing systems or burn the insects to death, and poisonous gases which suffocate them.

Although stomach poisons include strychnine, hellebore, barium carbonate and sodium fluosilicate the most generally used ones are made from white arsenic; namely, lead arsenate and Paris green. Of these two, lead arsenate is generally preferred because of its fineness, permanence, cheapness, non-burning of foliage and adaptability to application with other spraying materials. It may be purchased as a paste or a powder, the latter preferred. Hellebore, made from the roots of white hellebore, contains an alkaloid which, although an emetic to man, is a poison to insects without being injurious to foliage. It is therefore used as a spray or a dust on nearly ripe fruit, but its high cost is against its use except on a small scale.

Among contact insecticides, nicotine, either steeped from tobacco stems with water or as a commercial preparation, has the special advantages that it may be used on any foliage without damage and may be added to other sprays without risk of affecting its insecticidal properties. Nicotine is also used in two forms of dust, ground tobacco refuse and various dusts impregnated with nicotine or nicotine sulphate.

Various soaps are dissolved and applied as sprays especially to soft-bodied insects such as APHIS. They are also often added to oil and nicotine sprays. Most soaps used for spraying are made from whale oil or fish oil but ordinary laundry soap will answer for small numbers of plants.

As oils will not mix with water they are usually emulsified with soap, calcium caseinate, saponin or Bordeaux mixture. Such emulsions are popularly used to destroy scale insects and aphis eggs during the dormant period. Oils have little if any fungicidal value, hence are inferior to lime-sulphur solution Kerosene emulsion, formerly popular, is little used because of its injury to trees frequently sprayed with it and because emulsions of other oils have proved superior. *See* FUNGICIDE.

M. G. K.

INSECTIVORA, the scientific name for an order of insect-eating mammals, the shrews, hedgehogs and moles. Most insectivores are small furry creatures, terrestrial and nocturnal in their habits. The tree shrews are arboreal, the common mole is a digger, while some moles and shrews are aquatic. Besides insects they may include small animals, such as worms, in their diet. Hedgehogs, whose spines resemble those of the porcupine, eat a great variety of foods. Many insectivores have scent glands which, at least in the case of the shrews, give off an odor sufficiently unpleasant to protect them from the attacks of numerous possible enemies. *See also* HEDGEHOG; MOLE; SHREW.

INSECTIVOROUS PLANTS. The name insectivorous plants is applied to a group of diverse species not closely related phylogenetically but characterized by structures for the capture of small insects, which in some cases are known to be utilized by the plants as food. They belong to at least five natural families and are widely distributed over the world.

The largest and most conspicuous insectivorous plants are known as pitcher-plants, from the presence of hollow modified leaves often partly filled with water, and include the genera *Cephalotus, Nepenthes, Darlingtonia* (California), *Heliamphora* and *Sarracenia* (eastern United States). The pitchers range in size from that of a thimble to three feet long, in shape from nearly spherical to narrowly obconic, in capacity up to a quart, and are attached by the base. The broad terminal opening is provided with smooth hard ridges or with hairs or scales pointing downward. Below the rim are minute glands, the secretion of which probably serves to attract insects. Insects entering the pitchers are unable to climb back over the margin, fall into the contained water and drown. In *Nepenthes* a proteolytic enzyme is secreted by glands lining the pitcher and digests the insect; the results of digestion are absorbed by the plant. Enzymes are absent in *Sarracenia,* in the pitchers of which insect larvae and small types of other animal life often live in profusion, but the products of decomposition by bacteria may be used by the plant.

In a second type, including the genera *Drosera* (several species in eastern North America), *Pinguicula* (1 species in the northern states and Canada), and at least three others, the leaves are covered by viscid glands to which insects adhere. The leaves of *Drosera,* ranging in different species from circular and ½ inch in diameter to linear and a foot long, bear the glands on elongate stalks. When a small insect adheres to one of them, adjacent ones slowly bend over until they also adhere. An acid secretion is then produced containing an enzyme which digests the insect; similar enzymes are known in *Pinguicula.*

The remarkable Venus-flytrap (*Dionæa muscipula*) represents a third type in which parts of the leaves are motile and close like a trap. The leaves are in a basal rosette; the leaf-blade is two-lobed, each lobe semicircular in outline and ½ to 1 inch long. The lobes are united along their straight side, the whole blade resembling a widely open clam-shell in shape. The rounded margin is beset with long stiff bristles, their upper surface is thickly covered with minute glands, and each lobe bears three short bristles sensitive to contact. Contact of an insect with these bristles causes the two lobes to fold together immediately by contraction of tissue along their hinge-like junction. In folding, the marginal bristles interlace and escape of the insect is prevented. While the action is rapid, escape of a flying insect is possible before closure is complete and the prey consists chiefly of crawling forms. The trap may be sprung by contact with other objects, in which case the leaf expands in a day or less to normal position. When closed naturally by an insect or artificially by a small piece of meat or other digestible substance, the two lobes become firmly appressed, bringing the glands in close contact with the object. The glands then secrete an acid fluid containing a proteolytic enzyme and the leaf remains closed till the object is digested, reopening normally in about a week.

The actual value of insect food in the economy of the plants is largely conjectural, but experiments with sundew plants (Drosera) under controlled conditions have shown that those which catch insects considerably exceed those from which insects are excluded both in total weight and in number of fruits produced.

H. A. G.

INSECTS are members of the class *Insecta.* This descriptive name was given to animals whose bodies are composed of segments or sections (Latin—*in,* in and *secare,* cut). Formerly the name was used in a broad way to include the "hundred-footed" animals (centipeds), the ten-footed (crabs, lobsters, crayfishes), the eight-footed (spiders) and other groups as well as the six-footed (hexapods). The term is now restricted to the last mentioned class and thus the word insect has come to be synonymous with hexapod.

EXTERNAL STRUCTURE

The body of an adult insect is divided into three distinct regions, head, thorax, and abdomen.

Head. A relatively large compound eye is located on each side of the head. Three small simple eyes, usually arranged in a triangle, are near the top and front. The appendages of the head are the antennæ (feelers) and the paired mouthparts. The two antennæ are jointed and vary in form, being threadlike in certain moths, comblike in other moths, club-shaped in the butterflies, elbowed in ants and certain bees and wasps, sawlike, plumose, and with other characteristic forms in different insects. Such insects as feed by chewing or crushing their food have an unpaired upper lip (labrum), two pairs of jaws (mandibles and maxillæ) working sidewise, and a third pair of appendages which are partially fused to form the lower lip (labium). Grasshoppers, beetles, and hornets may be mentioned as examples of insects with chewing mouthparts. The mouthparts are variously modified and adapted to other

types of feeding. Thus a moth or a butterfly has a suctorial proboscis formed by modified maxillæ, while the mandibles are vestigial or absent; a true bug (order *Hemiptera*), whose mouthparts are formed for piercing and sucking, has the labium in the form of a grooved sheath protecting four slender lancelike bristles; and other insects are characterized by variations in accordance with their feeding needs.

Thorax. The appendages of the thorax are those which function in locomotion. There are three pairs of legs. These are usually all well-developed, though in some cases a pair may be reduced as in certain "four-footed" butterflies which hold their small front legs folded against the thorax. While with many insects the three pairs of legs are similar in size, structure and function, there are various types of modifications. The front legs often function as paws or hands for holding food or for digging. A praying mantis and a mole cricket, members of the same order (*Orthoptera*), may serve as examples of insects with conspicuously modified front legs. Such leaping insects as grasshoppers, leaf-hoppers and flea-beetles, have hind legs with thickened femora or elongated tibiæ, or both; and the fleas have all three pairs of legs adapted for jumping. The hind legs of bumblebees, honeybees and some other bees are equipped with pollen brushes which serve as a specialized type of apparatus for carrying pollen. The wings, typically four in number, are also attached to the thorax, being lateral outgrowths of the integument. The wing membranes may be smooth and naked as in the clear-winged insects, or covered with colored scales as in moths and butterflies. In form and structure they vary greatly in the different orders of insects. All four wings may function in flight as in butterflies, dragonflies, bees and others. The front wings, however, may be modified to serve as protective covers to the folded hind wings when the latter are not in use, as in beetles and grasshoppers. The flies (*Diptera*) are two-winged insects, their hind wings having become reduced to threadlike pedicles with knobbed tops. There are wingless insects but, except for the subclass *Apterygota,* they are descended from winged ancestors. The *Apterygota* (spring-tails and bristle-tails), however, are believed never to have evolved wings.

Abdomen. The number of abdominal segments is interpreted as 10 by some entomologists and as 11 by others, the difference being due to the fused condition of some segments causing difficulty in estimating the probably primitive number. The anal opening is situated on the terminal segment. The eighth and ninth segments bear appendages, known as the genitalia, which are connected with the reproductive organs. The genitalia of the males are the claspers and a smaller pair of valves associated with the intromittent organ, and those of the female comprise the egg-laying apparatus (ovipositor). Some insects have no external genitalia, the terminal segments being withdrawn in a telescopic manner. In many insects, however, the genitalia are developed as conspicuous appendages and function in different ways. Female crickets use their long stiff ovipositors for drilling holes in the ground in which they deposit their eggs. Bees, wasps, and some ants have ovipositors developed as stinging organs of defense. Saw-flies derive their name from the form of the ovipositors with which they saw slits in plant tissues in which they place their eggs. And one of the larger ichneumon-flies, parasitic on wood-boring larvæ, has a long wiry ovipositor which it uses with precision as an effective drill to reach the tunnels of its victims. Though most insects have no abdominal appendages other than the genitalia, some, as for example the mayflies, have slender terminal feelers (cerci).

Body-wall or Skeleton. The insect body-wall is composed of three layers, the outer layer (cuticle) being firm enough to serve as a substantial outside skeleton. This exoskeleton functions as a protective cover for the internal organs and as a framework for the attachment of muscles. The cuticle, when freshly formed, is elastic. It retains its flexibility at the sutures of the body and the joints of the appendages where movement is necessary. Other parts of the cuticle become tough and inelastic by the production of chitin in those portions where rigidity is an advantage.

INTERNAL STRUCTURE

Muscles. An elaborate system of muscles, which in some insects number more than 2,000 and in all insects are enormously in excess of the number possessed by man, function in the remarkable variety, precision, agility and strength of insect movements. The muscles that move the segments of the body are attached to the body-wall.

Nerves. The central nervous system consists of a double ventral nerve cord connecting the brain (ganglion), situated in the head above the esophagus, and the other nerve-centers (ganglia) which lie below the digestive tract in the thorax and abdomen. From the ganglia, the nerves radiate to the various parts of the body.

Respiratory System. A system of branching air-tubes (tracheæ) carry air to the different body regions and are supplemented by still finer tubes (tracheoles) branching out from them and supplying the various organs. Air enters the air-tubes through openings (spiracles) situated on the sides of the thorax and abdomen. There are ten, or fewer, pairs of spiracles. Insects do not breathe through any opening in the head. Certain water larvæ have a system of external tracheal gills. Other modifications also occur.

Digestive and Excretory System. The digestive canal, extending from the mouth to the anus, consists of three main regions, the fore-gut, mid-gut and hind-gut. The fore-gut, differentiated into mouth, esophagus, crop and gizzard, functions chiefly in mechanical processes. The mid-gut, or thick-walled stomach, is concerned with digestion and absorption. The hind-gut carries the waste products through the rectum to the anal opening. During

the earlier stages of its passage, the food is masticated and mixed with saliva. The secretions of the midgut correspond to those of the stomach and pancreas in vertebrates. Slender Malpighian tubes, functioning as kidneys, eliminate waste products from the blood and empty them into the hind intestine.

Circulatory System. The blood of insects is not confined to vessels except for a part of its course. It is kept in circulation by the pulsations of a contractile tube with chambers which run along the middle of the back just under the body-wall. The blood proceeds forward through this tube, or heart, into the body cavity where it flows in open streams, bathing the internal organs and entering the appendages. It returns to the heart through valvular slits.

Reproductive System. The ovary of the female and the testes of the male, with their associated ducts and glands, are well-developed systems situated in the abdomen. The external opening is near the anus. Their appendages have already been mentioned in the discussion of abdominal appendages. Mating between the sexes is necessary for the fertilization of the ova. The females of some beetles require several matings to secure fertility of all the eggs laid during one season. An example of the other extreme is furnished by the queen honeybee, an insect requiring but a single act of mating which serves to provide fertility of eggs which she subsequently deposits during the several years of her life. Mention will be made in a later section of larvæ which develop from unfertilized eggs.

METAMORPHOSIS AND LIFE-CYCLES

No insect emerges from an egg in a winged condition. The transformations that take place in the body of an insect are not completed until the time of its final molt. At this time the wings become fully expanded and are ready to function, unless, of course, the insect represents a non-flying species or one of the comparatively few apterous groups. Different orders of insects vary in the types of metamorphosis which they undergo. A maggot or grub or caterpillar exhibits no structural resemblance to the fly or beetle or butterfly which it will ultimately become. Any one of these insects, subsequently to hatching, experiences three well-marked stages; a larval period of growth, during which it attains its bulk; a pupal period of inactivity, during which its body undergoes fundamental structural changes; and its final period as an imago or mature insect. Such a transformation is called an interrupted, or complete, metamorphosis.

A grasshopper, however, begins its active existence already equipped with compound eyes, with mouthparts and legs of the same general type as those possessed by its mature parents. Except for its size and for the absence of wings, a very young grasshopper is not essentially different from an imago of the same species. The grasshopper wings are developed as external wing-pads which become larger with each successive molt until the final molt is experienced and the fully developed wings are released. The metamorphosis of a grasshopper is not interrupted by a pupal stage of inactivity. It is called a gradual, or incomplete, metamorphosis. The larvæ of insects undergoing such a gradual change, without a pupal intermission, are called nymphs. Certain water nymphs, of dragonflies and some others, are further favored by some entomologists with the special name of naiads.

Because of the chitinization of the epidermis or cuticle, the body-wall of the larva, or nymph, is too firm to expand to accommodate the growth of the young insect. The body of the larva, therefore, becomes too large and crowded for its armor-like skin. The difficulty of this predicament is met by a series of molts, at which times the cuticle is shed. Previous to this performance a new epidermal layer is formed inside the other. The old and rigid cuticle is then torn open by the pressure from within and the insect escapes from its out-grown coat. The freshly formed cuticle, being elastic, expands to the required limits of the body before it again becomes set by chitinization. Such a molting process is repeated, usually four to six times or more, the number of molts varying with the species of insect. Mayflies experience one molt after attaining functional wings. None of the other insects molt after they reach the mature or winged stage.

Most female insects deposit eggs which hatch after their exclusion. Such females are called *oviparous.* The females of certain insects, however, do not deposit unhatched eggs but exclude their young as larvæ or nymphs. Such females are termed *viviparous* and their young are said to be "born." The reproductive process of most insects is sexual. The ova of the female must be fertilized by the sperm of the male. There are, however, exceptions to this status. In some species, and indeed in all species in certain groups, the young, at least in certain generations, are developed from unfertilized ova of virgin females. Such a process is termed *parthenogenetic* reproduction. The aphids may serve as an illustration of a family of insects in which the females of all but one generation each year are both viviparous and parthenogenetic. In the fall generation male aphids are developed and the oviparous females deposit fertilized eggs. These eggs are the over-wintering stage of the aphid species. The forms which hatch from them in the spring are all viviparous females that give birth to nymphs developed from unfertilized ova. Several similar exclusively female generations occur during the summer previous to the development of the fall generation, comprising males and oviparous females which provide for the fertilized over-wintering eggs. Such a life-cycle, with its alternating generations differing in structure, is in marked contrast with such a simple life-cycle as is experienced by most families of insects.

SENSES AND SENSE ORGANS

Touch. The tactile sense organs are setæ which may be distinguished from the ordinary clothing-

hairs of insects by their connecting nerve-cells. They are most abundant on the antennæ, palpi of the mouthparts, and legs, though they are also distributed over the surface of the body.

Hearing. The fact that many insects are capable of producing sounds whose evident function is to attract other individuals of the same species, originally led to the assumption that such species, at least, must possess organs for the perception of sound. The study of certain structures, indeed, leaves no doubt of their being auditory organs. These structures are minute spindle-shaped auditory pegs found in the bodies of larvæ as well as of adult insects. They may occur singly but are usually grouped. In some insects, grouped auditory pegs are associated with tight external vibrating membranes. They are termed tympanal organs and are sometimes exceedingly complex. There are tympana or "ears" on the tibia of the front legs of crickets and long-horned grasshoppers. The short-horned grasshoppers have a tympanum on each side of the first abdominal segment.

Taste and Smell. The chemical sense-organs concerned with taste and smell are structurally alike. Those which are located in the mouth and the membrane of the buccal cavity, where they come in direct contact with food, are regarded as organs of taste. Similar organs situated in other parts of the body are regarded as organs of smell. Most histologists and experimenters agree that the olfactory sense in insects is chiefly located in the antennæ. That this sense is exceedingly keen is evidenced by the manner in which insects recognize the odors of plants and by the precision with which they direct their flight to their favorite foods. Odors appealing to one species may have no attraction for others, each seeking the scent that is associated with its appropriate food supply. Insects of one sex may emit a fragrance perceived by members of the other sex.

Sight. The location of the eyes has already been indicated in the discussion of the insect head. A simple eye (ocellus) is equipped with a single arched cornea or lens, while in a compound eye the cornea is divided into a number of facets. The number of such facets in a compound eye varies from a few in certain ants to thousands (10,000 to 20,000 or more) in the dragonflies. The simple eyes are believed to function chiefly in distinguishing light from dark. The compound eyes are quick to detect any moving object. It is known that insects may appreciate differences in colors, being attracted by some. Insect eyes of certain types are able to function both in very bright and in very dim light. This is made possible by a change of position of the pigment in accordance with the degree of light. In some insects each compound eye is divided into two, one being termed a day-eye and the other a night-eye.

OCCUPATIONS OF INSECTS

The industrious ways of the ants have been a matter of renown since the day of Solomon at least. The skill and diligence of these insects, however, are by no means exceptional. Because of their systems of organized labor, ants and other social insects merit all the attention accorded them; but many a solitary hexapod, in its rôle of laborer, artizan, craftsman, is no less deserving of our admiration.

Miners. As one of various excavators, a digger wasp may be cited. With her jaws to serve for pick-axe and bucket, she digs a vertical shaft in the ground. She then turns hunter and captures a sort of caterpillar dietetically appropriate for her young. After stinging her prey in a manner to paralyze it but not to kill it, she places it at the bottom of her tunnel as a supply of fresh meat for the infant larva which will soon hatch from the egg she leaves with it. The process of filling the hole is no less efficient than the digging. Pawing sand with her feet, or loosening it at the top of the tunnel with her jaws to let it slide down, she works until the combination of nursery and storage cellar is closed. Then, seizing a pebble in her jaws for a ramming tool, she tamps the surface until it is firm.

Masons. Other species of wasps, working as masons, construct nurseries for their young with a plaster of sand set with a salivary cement. Because of the form and perfection of some of these structures, the species that make them are called potter-wasps or jug-builders.

Paper-makers. As expert paper-makers, men may point with just pride to their elaborate machine-equipped mills. Yet hornets, with no other tools than their mouthparts and their front feet, have been manufacturing pressed paper sheets from wood-pulp for unknown thousands of years, a durable grade suitable for the walls of their apartment houses even when exposed to wind and rain.

Tailors. The tasks of a tailor are not too difficult for mere insect infants, and many larvæ fashion their own clothes, those of each species maintaining a peculiar pattern and selection of materials. Some cut bits of leaves or small twigs and fasten them together with silken thread into mantles that protect their bodies without hampering the movements of their heads and feet. These tailors, of course, are the case-bearers, or the larvæ of certain groups that differ from others in that they cover their nakedness with protecting raiment.

Spinners and Weavers. Many insects have internal silk-glands from which are exuded liquid streams of silk that hardens on contact with the air. In the larvæ of moths and butterflies and some other orders, the silk-glands are modified salivary glands, and the silk issues through an opening in the lower lip. The larvæ of certain moths called silkworms, are the most famous of the spinners and weavers; though other caterpillars, that vary the process by manufacturing a sort of hair-cloth, are no less interesting. As an example of one of these, a hairy meadow caterpillar (*Ctenucha virginica*) will serve. He first makes, with the silk that drools from the opening in his lower lip, a thin mat about his own

length. Clinging to this by the hooks of his so-called false-feet, he works at the sides and ends of the cocoon until he has constructed above him a shallow oval with the edges evenly woven down to about an eighth of an inch. The fabric that he weaves, unlike that of many caterpillars, has relatively little silk in it, for his cocoon is chiefly of hair-cloth. The source of his silk has been indicated. The hairy warp that composes the heavier part of the texture he obtains by reaching back with his head and jerking the hair from his skin. A wisp secured, he sways his head back to the cocoon edge and thrusts it endwise into the entangling silk. Then, throwing a newly spun thread of silk in and out, he weaves the filmy weft that holds the hairy warp in place. Thus, plucking the hair from his skin, mouthful by mouthful, putting each bundle into place and winding it with new-spun silk, he weaves his blanket, shaping it into a sleeping-bag as he works.

THE NATURAL INFLUENCE OF INSECTS

Just how many species of insects there are in the world is not known. Many species have not yet been named and described. Some have been described under more than one name, because of certain taxonomic difficulties. Several entomologists have attempted to estimate the number of species. Their figures range from a probably much too conservative 2,000,000 to a possibly extravagant guess of 10,000,000. It is not of consequence to know the exact number of species; but it is important to realize that insects in general are exceedingly prolific and that the total number of individuals is inconceivably enormous. The antiquity of insects is indicated by fossil impressions which show that insect life was already abundant during the Carboniferous age which, according to estimates by geologists and physicists, was somewhere between 40,000,000 and 146,000,000 years ago. Their abundance, their antiquity, their variety, their remarkable structural equipment, their activity, have combined to endow insects with a powerful influence on plant and animal life in general.

Vast hordes of animals have depended entirely or in great measure on insects for food. Plants have evolved their showy flowers, with their attractile colors and odors and nectar, to the end that insects may visit them to insure cross-pollination and consequently fertile seeds. Insects have appropriated plants and animal substance to their needs and, in return, have given lavishly of their own substance toward the maintenance of a balance in nature. If the debt of mankind to this more ancient class of fellow-denizens of the earth is evaluated, we face quite fundamental facts relating to health, clothing and food. In common with all other land animals, man has profited by the health-patrol of scavenger insects, those omnipresent sanitation experts. Centuries of silk and all its industries are dependent upon insects. The various products of the cotton plant (cloth, oil for food and soap, cottonseed meal and many others) are available because insects visit its flowers as pollen-bearers. Apples, berries, melons, oranges, peaches, pears and other juicy fruits are an annual gift from insect pollinators. For most of our vegetable seeds we are likewise indebted to these hexapods. Indeed, if it were not for insects, nearly all plant foods would be deleted from our menu except certain nuts from wind-pollinated trees, the wind-pollinated cereals, the few self-pollinated plants and those propagated without seeds.

But far-reaching utility and industry and commerce do not comprise our only benefits from insects. Such human pleasure as is elicited by color and fragrance of flowers, whether wild or garden varieties, is by grace of the insects for which such attractants were evolved. Again, the pleasure derived from bird song is appropriate to this discussion. For since most perching birds depend on insects either exclusively or in large measure as food for their nestlings, the earth would, in the absence of these insects, be deprived of many species of birds. If our debt to insects is inconceivably intricate and extensive, the other side of the picture is distressing in its proportions. Wounds inflicted by biting insects range from temporary irritations to dangerous results. Flies, fleas, mosquitoes and some other insects are carriers of human diseases. No cultivated crop is immune to insect attack. Certain plant diseases are spread by insects. Domestic animals must be protected from insect parasites. We dispute with insects for the possession of stored food and woolen cloth. "Warfare" is not too extravagant a term to express the necessary status of our relations to insect pests. Whether, in the long run, mankind will be wise enough and skillful enough and fortunate enough to continue to profit by the benefits of insects and at the same time escape too whelming damage from insects is a matter for experimentation and prophecy.

Entomologists divide the class *Insecta* into orders that vary somewhat in number in accordance with the range of insects grouped under certain of the orders. Twenty-three orders are listed here.

ORDERS OF INSECTS

Scientific Name	Common Name
THYSANURA	Bristle-tails
COLLEMBOLA	Spring-tails
PLECOPTERA	Stoneflies
ORTHOPTERA	Grasshoppers, Crickets, etc.
ODONATA	Dragonflies
EPHEMERIDA	Mayflies
ISOPTERA	Termites
MALLOPHAGA	Bird Lice
CORRODENTIA	Psocids
THYSANOPTERA	Thrips
DERMAPTERA	Earwigs
ANOPLEURA	Lice
HOMOPTERA	Cicadas, Aphids, etc.
HEMIPTERA	Bugs
TRICHOPTERA	Caddisflies
NEUROPTERA	Lace-wings, etc.
MECOPTERA	Scorpionflies
STREPSIPTERA	Stylopids
COLEOPTERA	Beetles
LEPIDOPTERA	Moths, Butterflies
SIPHONAPTERA	Fleas
DIPTERA	Flies, Mosquitoes, etc.
HYMENOPTERA	Bees, Ants, etc.

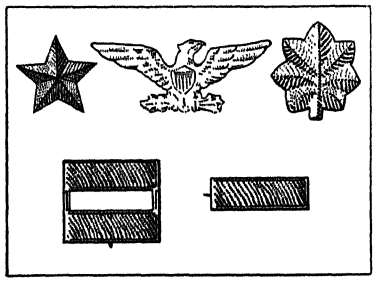
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E. M. P.

INSECTS, INJURIOUS. *See* INJURIOUS INSECTS. *See also* the articles: ARMY WORM; BROWN-TAIL MOTH; CABBAGE BUTTERFLY; CHIGOE; CODLING MOTH; CORN BORER; CUT-WORM; FRUIT-FLY; GYPSY MOTH; HESSIAN FLY; JAPANESE BEETLE; MOSQUITO; TERMITE; TSETSE FLY; WIRE-WORM.

INSIGNIA, MILITARY AND NAVAL, devices which indicate the branch of the military or naval establishment of the United States to which individual members belong. They constitute parts of their uniforms, as do also insignia of rank, and as such are prescribed in regulations promulgated, under authority of the President, through the War and Navy departments and the Headquarters of the Marine Corps, respectively.

To describe the distinctive insignia of each of the several branches of the armed services would extend this article beyond its proper limits. A few examples must suffice. In the Army crossed rifles connote Infantry; crossed sabers, Cavalry; crossed field guns, Field Artillery; wings and propeller, the Air Corps; and the caduceus is the emblem of the Medical Corps. In the Navy a five-pointed gold star marks the line officer; and a spread oak leaf, gold, surcharged with an acorn in silver, the medical officer. The insignia



INSIGNIA OF COMMISSIONED OFFICERS
Showing silver star, spread eagle, oak leaf, double bar and single bar

of the Marine is a device including the eagle, globe and anchor.

In each of the services different insignia of rank are prescribed for wear with different uniforms. Such insignia take the form of epaulettes, shoulder knots, shoulder straps, shoulder loops, stripes varying in number and width, and knots and loops varying in the number of elements. Notwithstanding all these variations, insignia of rank common to all three of the services here mentioned are prescribed for wear on epaulettes in the Navy and on shoulder straps and shoulder loops in the Army and Marine Corps, as indicated in the following table.

INSIGNIA OF RANK—COMMISSIONED OFFICERS

	Army	Navy	Marine Corps
Four Silver Stars	General	Admiral	
Three Silver Stars	Lieutenant General	Vice Admiral	
Two Silver Stars	Major General	Rear Admiral	Major General
One Silver Star	Brigadier General	Commodore	Brigadier General
Silver Spread Eagle	Colonel	Captain	Colonel
Silver Oak Leaf	Lieutenant Colonel	Commander	Lieutenant Colonel
Gold Oak Leaf	Major	Lieutenant Commander	Major
Two Silver Bars	Captain	Lieutenant	Captain
One Silver Bar	1st Lieutenant	Lieutenant Junior Grade	1st Lieutenant
One Gold Bar	2nd Lieutenant	Ensign	2nd Lieutenant

See also DECORATIONS.

E. A. K.

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INSOMNIA. Minor sleep disturbances are so widespread that it is not satisfactory to characterize insomnia as a deviation from average in sleep. In general it is desirable to speak of insomnia as including disturbances of sleep that annoy or may harm the individual.

Complete loss of sleep, despite attempts to sleep, is relatively rare. It is not especially serious, provided the individual remains physically inactive and in bed in a darkened room. While the complete sleep loss may be genuine and associated with physical disease, in most instances it is without ascertainable cause other than being a sign of poor emotional control or a nervousness. Much so-called complete loss of sleep is more apparent than real. Sleep is often obtained, but the subject experiences dreams of such vividness that he is not aware of having been asleep, or is a hypochondriac on the topic of insomnia and cannot admit that he has slept. In all cases of this apparently complete sleep loss, a thorough physical examination should be undergone first to determine possible organic causes. Following this, the assistance of a mental hygienist or psychiatrist should be secured to obtain more adequate emotional control and attitudes. In some instances a suggestive therapy is sufficient; in the majority of these cases of functional insomnia, however, a rather thorough re-working of the individual's mental life and attitudes is necessary, following the methods of PSYCHOANALYSIS.

Sleep walking or somnambulism, and sleep talking or somniloquism, are partial disturbances of sleep which are considered to be without organic basis and to indicate need for improved individual mental hygiene. Similar disturbances, although not so common, are nightmare or pavor nocturnis, and bedwetting or enuresis. The last two are not limited to childhood.

Occasional wakefulness during the night is found

in approximately fifty per cent of adults, and increases slightly with increased age. The wakefulness may be caused by gastric distress or indigestion. Or it may be caused by hunger pangs due to the contractions of the empty stomach which put in an intermittent appearance four or five hours after eating. The accumulation of gas in the intestinal tract may be the internal stimulus to awaken the sleeper. With increasing age, or when large amounts of liquids are consumed in the evening, the wakefulness may be due to increasing pressure on the wall of the bladder. In other instances, dreams may be the cause of wakefulness. A significant proportion of wakefulness is the result of external disturbances, such as the noise of a passing train or the rays from automobile headlights entering the sleeping chamber. Wakefulness at approximately the same hour each night is often associated with the passing of a motor truck at the same time each night. Emotional experiences during the day are a potent factor in causing wakefulness of greater or less duration in the night.

Difficulty in going to sleep after retiring is more frequent than wakefulness during the night, and increases rapidly with increasing age. Coldness of the extremities, gastric distress, and possibly hunger pangs are the most common organic causes of this disturbance. Exciting evening activities, apprehension about the coming day, afternoon or evening naps, or undue preoccupation with thoughts of sleep are more frequent than the organic causes of this slight disorder. The difficulty of old persons in going to sleep nights is probably due to the large amounts of sleep they obtain during the day. Except in the case of a few sensitive individuals, coffee and tea in ordinary amounts with the evening meal are probably not a cause. The virtues of a warm tub bath for overcoming this difficulty are doubtful. A sweetened warm milk drink, to which readily digestible food concentrates rich in enzymes may have been added, is helpful in ordinary instances of difficulty in going to sleep, but diuretics should be avoided, as well as large quantities of liquids or foods which may cause gastric distress; this may be helpful, also, in avoiding wakefulness later by delaying hunger contractions of the stomach.

Awaking early mornings is relatively rare. When not due to the need of evacuating the bladder or hunger, it may be associated with the entrance of sunlight into the bedroom, or to the noise of early morning activities outside. While it may be a result of having had sufficient sleep, first consideration should always be given to possible external or internal disturbances as the cause.

The most common form of sleep loss is that caused by the necessity of being awakened mornings by some prearranged stimulus in order to be at work on time. Possible ill-effects from this are yet to be determined, but it is suspected that the need for having a morning call indicates either an inadequate amount or inadequate quality of sleep. *See also* SLEEP. D. A. L.

BIBLIOGRAPHY.—Joseph Collins, *Insomnia,* 1930; Donald A. Laird and Charles G. Muller, *Sleep,* 1930.

INSPECTION AND SURVEY BOARD, NAVAL. *See* BOARD OF INSPECTION AND SURVEY, U.S. NAVY.

INSPECTOR GENERAL, in the army, an officer serving in the inspector general's department, which is in charge of all inspection. The head of this department is, strictly, the inspector general of the army, but all his subordinates are also termed inspector generals. In rank, inspector generals are ordinarily majors, colonels and brigadier generals. Their duties charge them with the proper inspection of troops with regard to efficiency, equipment and strength; misconduct of officers; accounts; armories, arsenals, depots and the like.

INSPIRATION, a manifestation of the creative impulse. At moments of inspiration both the creative impulse and the creative imagination are at their best. Psychologically, inspiration is no different from other work activity. It follows a curve similar to that used to measure efficiency. It may reach higher points, but its rise and fall are inevitable. On the upward trend an inspiration curve may show an expenditure of considerable effort, accompanied by unpleasant feelings. After the maximum point of effort has been reached, there follows a let-down accompanied by a pleasant feeling tone. The point where this change takes place is the moment of the inspiration. Although there is a rise and fall of efficiency in work, not all curves are characterized by the exhilaration of inspiration. The intuitive insight of inspiration is a perfectly natural phenomenon. It may best be illustrated by the heights of creative activity in the works of art, literature, science, ethics and religion. These works are inspiring, just as some personalities are inspiring, because they help to lift one to greater insight and deeper understanding.

INSTALLMENT BUYING, a transfer of WEALTH, the payment for which is deferred in whole or in part to the future, and is liquidated piecemeal or in successive fractions, under a plan agreed upon at the time of transfer. This method of buying is used in the extension of both producer and consumer CREDIT, the growth in the latter field being the cause of considerable study due to the feeling that an unduly rapid extension might undermine the whole credit structure. This fear is based largely on the assumption that the consumers who thus purchase are anticipating or mortgaging future income.

Excluding homes, the consumer goods purchased on installment are chiefly automobiles and household goods and equipment. The estimates indicate that the amount of installment paper outstanding for consumption goods at any one time is between two and two and one-half billion. Producer goods purchased and financed in a similar way are industrial and farm equipment and automobiles. In installment buying at the time of purchase, the buyer usually makes an immediate or down payment of a fractional part of the price of the commodity purchased. This usually amounts to from 10% to 33⅓% although in some cases no down payment is required and occasionally

50% is required. The balance is paid usually in equal fractions each month. Sometimes weekly payment periods are used instead of monthly ones and sometimes longer periods. On the average, these payments in the purchase of automobiles are spread over a period of 12 months. Terms of payment are influenced by the nature of the commodity, the amount involved, the credit status of the buyer, competition and the policy of the seller.

The sale is usually financed by the seller himself taking a series of notes from the buyer for the unpaid balance, or by a finance company taking such a series of notes made by the purchaser and advancing the funds immediately to the seller. Frequently the buyer buys a new model of a product and receives an allowance on an older model which he already possesses. This allowance may constitute the original down payment.

The seller protects his interest in the commodity sold through such legal instruments as conditional sales contracts, chattel mortgages, or leasing agreements, depending upon the individual state laws covering such documents. Insurance policies (*see* INSURANCE) are also drawn to cover the risk involved, such as the possible loss by fire or theft of the object sold.

The buyer pays an amount above the selling price of the commodity which covers the interest upon the unpaid balances, insurance premiums, and in addition a service or finance charge. In some lines, for example, furniture, the seller starts with two prices, a cash and a time or installment price. Losses on installment sales are generally small. These differ in different lines and among different houses in the same line. They may be a fractional part of 1% or over 5%. Collection costs and delinquencies are likely to be the costly items.

To the seller, the installment method is a competitive device to direct and control the purchasing power of the buyer; to the buyer it is a means of securing desirable goods first and to enjoy them while paying for them. Installment buying sometimes results in the purchaser anticipating future earnings. Frequently people able to pay cash will make purchases on this basis because they feel it less. Many have assets which they could convert into cash but prefer not to do so, and hence, buy on installment. The better class of houses make such sales only after careful credit analysis and prefer not to run the risk of being called upon to repossess the goods sold. Others are largely sales racketeers.

If installment selling rapidly expands the market for a commodity made under conditions of decreasing costs, future buyers may benefit by the lowered price, and insofar as other goods entering into the production of the first are similarly produced, the effect is pervasive. Commodities produced under conditions of increasing costs have the opposite effect.

Some advocates claim that individuals are able to enjoy a higher standard of living, become more productive, learn how to budget expenditures when they buy goods on installment. Critics of the system claim that the debt burden results in worry and lowered production, in foolish purchases, and in extravagance resulting from the ready availability of credit. G. F.

BIBLIOGRAPHY.—E. R. L. Seligman, *Economics of Installment Selling*.

INSTERBURG, an industrial city in East Prussia, situated at the junction of the Inster and Augerapp rivers. It has textile mills and other plants and trades chiefly in grain, horses and cattle. It has a church of the 17th century Renaissance style and a castle of the 14th century which belonged to the Teutonic Order. The city was built up around the castle, becoming a city in 1583; in Sept. 1914, it was occupied by the Russians. Pop. 1925, 39,390.

INSTINCT, in psychology, a series of acts of an hereditary character. Generally these acts are adaptive, although the individual may be quite unaware of their purpose. What makes them instinctive is their hereditary nature. Instinct is contrasted with habit, which is acquired. The test of an instinct is performance without learning. Some instincts may not appear at birth, but if on their first manifestation the acts take place in a relatively perfected form, the behavior thus appearing may rightly be designated as instinctive. Among the animals instinctive behavior plays a much more important rôle than it does in man. This of course means that the life of the animal is much more circumscribed. It does not follow, however, that animals cannot learn or that they cannot display intelligence. In both these respects the animal is more limited than man, but animal intelligence has been demonstrated beyond question.

Watson has classified instincts among the vertebrates as: instincts having to do with action systems, food, shelter, rest and sleep, sex, defense and attack and vocalization. Besides these there are special and unclassified instincts of a miscellaneous sort. The migration of birds is an example of special instinct. The pecking of the chick, the swimming and diving of the moor-hen, the flying of the house martin and swallow and the nest building of the canary and bullfinch are all examples of instinctive behavior. Lloyd Morgan found that these activities could be performed on first attempts when occasion demanded it. They did not have to be learned and hence were truly instinctive.

Among the theories atempting to account for the origin of instinct are three that have received recognition, viz., the reflex, the lapsed intelligence and the organic selection. The reflex theory would make instinct consist of a series of reflexes that have been built up by adaptation. The theory's main difficulty lies in demonstrating the adaptative character of separate reflexes; until these reflexes are sufficiently pronounced to become of some value, there is no reason to assume their survival until the perfected instinct could use them.

The lapsed intelligence theory holds that instinct is automatized intelligence, that at first the acts were built up as habits are now, but that in the course of time they become racial habits. This theory presup-

poses intelligence at a very low stage of organic development and also must assume the inheritance of acquired characteristics in order to be effective. Occupying a middle position between these two is the theory of organic selection. It also assumes the coextension of consciousness with life and probably reads more purpose into the lower manifestations of life than actually exists. It does not, however, premise the hereditability of acquired characters.

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INSTINCT IN MAN, a concept that has been under fire in recent psychological literature. WILLIAM JAMES shocked the world when he claimed, in *Principles of Psychology,* 1891, that man has more instincts than the animals. Man had been considered as being endowed with reason, whereas the animal was guided by instinct. James recognized some two dozen or more different instincts. Since his time it has become the fashion to explain most human conduct by means of instinct. The concept, thus abused, soon lost its scientific validity. But within the last decade the pendulum has begun to swing back, and as usual, has gone to the other extreme. Watson speaks of "inherited reaction patterns" and Allport refers to "prepotent reflexes." Dewey recognizes instinct but not "instincts."

The difficulty of the problem lay in distinguishing habit from instinct. It was easy enough to make a theoretical distinction by saying that the one is acquired and the other inherited, but in the more difficult problem of classifying instincts and specifying them as to number, no agreement was reached. The outcome has been the placing of a greater emphasis upon the impulsive and volitional side of life, with far richer possibilities for the guidance and control of these activities. Many social habits that have hitherto been traced to instinct, such as war and acquisition, are now frankly recognized as nothing but habit. Human nature is not fixed but is quite plastic and flexible.

INSTITUTE OF FRANCE, a group of French societies comprising (1) the ACADÉMIE FRANÇAISE; (2) the Académie des Inscriptions et Belles-Lettres for the study of languages and inscriptions; (3) the Académie des Sciences for the study of pure science; (4) the Académie des BEAUX-ARTS for the advancement of painting, sculpture and other branches of the fine arts; (5) the Académie des Sciences Morales et Politiques for the study of philosophy, economics, law, political science and related subjects. The membership and prizes awarded by each of the societies in its field of learning command high prestige. Candidates are elected by ballot as regular, corresponding, honorary or foreign associate members. First known under its present name in 1832, the institute is the outgrowth of earlier similar organizations which began with the Institut National des Sciences et des Arts in 1795. The Académie Française, the oldest of the member societies, met for the first time in 1634. The institute holds regular meetings attended by representatives of member societies.

INSTITUTIONAL ECONOMICS, a much discussed and controversial subject. Almost all economists recognize that there is a valid field of institutional economics but precisely what that field is, still remains unsettled. Likewise there is considerable controversy as to who should be considered an institutional economist. Thus the recognized founder of the institutional approach, THORSTEIN VEBLEN, held that the received classical tradition was useless for purposes of analyses of modern economic institutions; but, on the other hand, any economist claiming to deal with institutions has been asserted to be an institutionalist. The great exponent and one of the founders of the classical tradition, John Stuart Mill, was an institutional economist, since he held that distribution was a matter of institutions. Consequently the whole discussion of institutional economics has become a controversial dispute, and the work of some ardent disciples as well as opponents, has consisted entirely of polemics.

Considerable confusion has resulted from the lack of clarity in the meaning of institution. As defined by Veblen, an institution is a "method of action arrived at by habituation and convention, and agreed upon." As such, institutions are human actions and institutional economics was not to be considered a species of economics, but *the* method of economics. The controversy over institutional economics was not one over content or subject matter of the field, but between radically different methods of analyses.

But the radical departure, which Veblen advanced, has not been the accepted one in defining the field of institutional economics. Neither those who claim a great scope for so-called institutional economics, nor those who would limit its scope, have in their discussions accepted Veblen's conception of an institution. Instead they have conceived an institution as a force outside of individual action and in conflict with human nature. In consequence, there is individual economics and institutional economics. In this way institutional economics takes on various forms but always with the underlying assumption, usually uncritically assumed, that the so-called individual economics is the basis of analyses of the manifestations. In other words, individualistic economics works itself out in various forms of institutional economics. These forms vary all the way from historical economics to what might be called statistical economics and applied economics.

In this respect institutional economics is an old story in the history of economic thought. Thus institutional economics is conceived to be the presentation of a genealogical history of institutions, or what the Germans called historical jurisprudence; i.e., the state, property form of business units. It becomes a modern version of the old German historical school. Still others conceive by institutional economics a sociological treatment. The realm of economic behavior is held to be inadequately explained by recourse only to the economic elements. The institutional elements, such as the state, must be taken into consideration as

modifying economic action. In this institutional analysis all the factors are supposedly taken into account.

So closely allied as to be almost identical, is the view that it is applied economics. The great norm or principles of individualistic economics is assumed to be only approximated in any scheme of institutions. A study of the specific institutions allows for the proper deductions or additions to be made. In this respect institutional economics might be called statistical economics. Essentially, therefore, with Veblen out of the way, institutional economics as today maintained is, as one compiler of prevalent opinion has stated, concerned with historical and descriptive work. The basic analysis is still that of the classical tradition.

J. D.

INSULAR CASES, 1901-05, a group of cases which resulted in notable decisions of the United States Supreme Court in which the status and constitutional rights of Cuba, Porto Rico, Hawaii and the Philippine Islands were defined. The concrete issue of the *De Lima, Dooley,* and *Downes* cases was whether Porto Rico upon its cession by Spain ceased to be foreign country within the meaning of the United States tariff laws. The consensus of the Court was that the Government of the United States has power to hold territory without immediately incorporating it into the United States; that Congress can determine when acquired territory has reached the state when properly it should be incorporated; that Porto Rico, although not a foreign country in an international sense, continued to be foreign in a domestic sense because it had not been incorporated into the United States but was merely appurtenanced thereto as a possession. In *Hawaii vs Mankichi* the Court held the constitutional guarantees of trial by jury inapplicable to the Hawaiian Islands, and in *Dorr vs. United States* that the right of trial by jury was not extended to the Philippine Islands of its own force. In 1918 the Court held (*Porto Rico vs. Tapia*) that rights guaranteed by the Constitution might be withheld from an unincorporated territory even though Congress had granted United States citizenship to the inhabitants.

INSULATION, ELECTRIC, non-conducting material used for covering or supporting conductors to prevent the escape or transfer of ELECTRICITY. The property of CONDUCTION is not peculiar to any one class of substances, but is probably shared to some extent by all materials. However, the readiness with which electricity flows in different substances varies greatly. The best conductors are those in which the electric current flows most readily; the poorest are called non-conductors, or insulators. Glass, porcelain and rubber offer enormous RESISTANCE to the flow of electricity and are generally used as insulators.

TELEPHONE, TELEGRAPH and power circuits (*see* POWER TRANSMISSION) are supported on glass or porcelain insulators to prevent the flow of current to another wire, to supporting poles, to buildings or to the ground. For interior circuits, insulated wire is used for the same purpose, the insulation in this case consisting of materials used as a coating. Silk and cotton are used for wire insulation, the latter being more effective when impregnated with paraffin or shellac. Baked-on enamel is used for insulating wire for special purposes.

Telephone cables are made up of hundreds of pairs of small copper wires, each insulated from the others by a covering of paper or wood pulp, the whole being encased in a lead-antimony sheath which excludes moisture.

L. B. S.

INSULATION, HEAT, substances used to retard the flow of heat from one body or space to an adjacent body or space of lower temperature. The materials most commonly used in the manufacture of insulation for piping in connection with power, heating and refrigerating plants and for covering tanks, heaters and boilers include ASBESTOS, carbonate of magnesia, DIATOMACEOUS EARTH, CORK, mineral wool and hair and wool felts. *See* FELT.

Asbestos is, perhaps, the most widely used in connection with high temperatures. In moulded forms it is commonly combined with such materials as silicate of soda which give it greater strength, but, unfortunately, somewhat reduce its resistance to the passage of heat. The form of magnesia used for insulation is artificially prepared, being a compound of carbonates and hydroxides. It is mixed with other substances which act as binders—a well known commercial type being 85% magnesia and 15% binder. It is widely used and is good at temperatures up to 550 or 600° F. Diatomaceous earth is a marine deposit composed of practically pure silicate. It is good at temperatures up to 1,000° F. but, like the other materials mentioned, must be mixed with a binding material. Rock wool and slag wool are forms of mineral wool commonly used as insulators. They are made from moulten silica rock and blast-furnace refuse, respectively, by drawing them into long fine fibers. Rock wool is used at temperatures up to 1,200° F. A new type of insulation used in Europe for steam pipes comprises sheets of aluminium foil with air spaces intervening.

In refrigeration work, cold water pipes are frequently covered with cork insulation, made by moulding granulated cork with a suitable binder. This material is especially satisfactory where dampness exists. Hair and wool felts are very good insulators at low temperatures but are subject to the ravages of vermin and cannot stand hard usage.

Heat insulation for walls and roofs of buildings may be in the form of flexible sheets placed on the studs or sheathing, filler material placed between the studs, rigid or semi-rigid sheets or boards and a combination of insulating material and lathing. Of the flexible sheeting, "tar paper" is perhaps the most effective material, considering the cost. Felts and quilts are widely used and are efficient, quilts comprising two or more layers of paper between which is placed some fibrous insulating material. Balsam wool, a fibrous material made from the balsam tree, is often used in quilt form. For filling between

studs, sawdust, ground cork, asbestos, rock wool and powdered gypsum are used. Rigid and semi-rigid wall-boards usually have pulp, compressed fiber or gypsum as their principal constituent. Combination insulation and lath comprises a heavy paper to which the lath are attached. It is not highly efficient.

In the construction of FURNACES and KILNS a layer of insulating brick is sometimes placed between the refractory lining and the exterior wall of the structure. Bricks containing diatomaceous earth are frequently used.

INSULATION, SOUND, any means whereby the passage of sound from one portion of a building to another is minimized. It involves two distinct types of problems: first, the reduction of the air-borne sounds; second, the elimination of vibrations set up in a structure by sources which are in solid contact with it.

Experimental work has shown that insulation against air-borne sounds is almost wholly a matter of the weight and construction of partitions rather than of materials. The sound insulating efficiencies of normal types of wall construction, including gypsum and clay title, solid plaster, plaster on lath or wood studs, and brick, run, almost without exception, in the order of their weight per unit area independently of the particular materials employed.

Double walls, without structural tying, afford more insulation for a given weight of construction than do single walls. The degree of insulation increases with increased separation and with decreased structural connection between the two walls. Sound insulation may also be increased without undue increase of weight by elastically connecting a light surface construction to a heavier sustaining partition.

A similar method has been found effective in reducing structurally-borne vibrations through floors. In one system of floor insulation, the wooden "sleepers" that carry the finished floor are held in small and somewhat elastic steel "chairs," thus affording a resilient structure which absorbs the vibrations imparted to the floor. Layers of felt or fiber boards placed between the finish floor and the sub-flooring are comparatively ineffective.

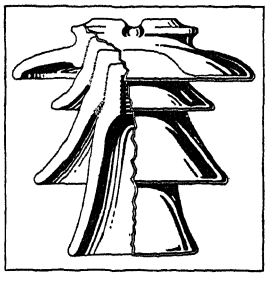


FIG. 1. PIN TYPE INSULATOR

The chief virtue in so-called sound-proof doors lies in their weight and the precautions taken to seal the openings around the edges.

In the soundproofing of airplane cabins double walls with a loose filling material between have been found effective. Best results have been obtained with a heavy outer wall and a lighter inner wall. *See also* ACOUSTICS OF BUILDINGS. P. E. S.

INSULATORS, ELECTRIC, non-conductors made of glass, porcelain and patented compounds used for supporting electric conductors on poles or towers, most commonly used for TELEPHONE and TELEGRAPH circuits and for low-voltage power lines. Porcelain is almost universally used for high-voltage lines. The pin-type (*see* Fig. 1), made in sections and cemented together, is used for lines of potentials up to 66,000 volts, suspension insulators (Fig. 2) being used exclusively for lines of higher voltage. The number of units in an insulator is adapted to the line voltage, the allowable operating voltage being approximately 10,000 volts to ground per unit. Most patented compounds do not "weather" well. *See also* POWER TRANSMISSION, ELECTRICAL. C. L. D.

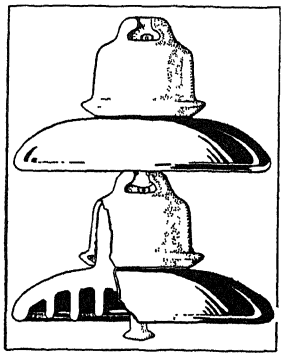


FIG. 2. DOUBLE UNIT SUSPENSION TYPE INSULATOR

INSULIN, a product of the pancreas, is formed in the cells of the islands of Langerhans, is secreted by them into the blood stream and is distributed by the blood to the liver and other organs where it stimulates the utilization of sugar. It is a catalyzer, or hormone, behaving in this respect much like the ferments of the digestive juices. Its absence or deficiency results in diabetes mellitus. The discovery of a method of recovering insulin from the pancreas of animals was made in July 1921, by Bunting and Best. Their researches and those of their associates, Macleod and Collip, opened the way to the use of pancreas from slaughter houses for the alleviation of human diabetes. They were awarded the Nobel Prize in medicine in 1923.

The preparation of commercial insulin is by extraction of pancreas with acidified 80% alcohol. The active substance is soluble in alcohol of this strength, but insoluble in more highly concentrated alcohol, and advantage is taken of this property to separate it from the proteins in the original extract. Further purification is accomplished by a variety of other means and sterilization by filtering through Berkefeld candles. The final product, a white powder, is brought into aqueous solution with acidified water (pH 2.5) and bottled in sterile glass ampoules. Crystalline insulin has been prepared. Evidence points to a polypeptid or complex protein-like structure containing the amino-acid arginin in relatively large amount.

When insulin is given to fasting animals, it so stimulates the utilization of glucose that the blood is robbed of its normal content of this sugar and the animal loses consciousness and may be thrown into convulsions. This is the hypoglycemic reaction which clinical experience has made familiar to physicians and their diabetic patients. It is not dangerous in man and can be avoided by the exercise of care in selecting the proper dosage. Advantage was taken of the phenomenon to standardize the original preparations and a unit of insulin was first defined as the smallest amount which would provoke hypoglycemic symptoms in a fasted rabbit. At the present time com-

mercial preparations are made to conform in activity to a stabile dry insulin powder in the possession of the Toronto Insulin Committee and the Medical Research Council of Great Britain. This contains 8,000 units to the gram and is recognized by the League of Nations as an International Standard.

The activity of insulin in diabetes is influenced by the diet. The number of grams of carbohydrates for the utilizations of which each unit will provide (the glucose equivalent of the unit) is from 1 to 2 when little carbohydrate is included in the food; it is greater with more carbohydrate. The dose required for a patient depends upon the composition of the diet and varies from a few units to 80 or more a day. Insulin must be injected hypodermically. It is completely inactive if given by mouth and the very large number of proprietary pancreas preparations which are advertized as being effective by mouth are in no instance trustworthy. R. M. W.

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INSULITE. *See* FIBER BOARDS.

INSURANCE, protection against financial loss likely to occur through misfortunes as fire, death, accident, tornado, shipwreck and other contingencies of human activity. Such protection is acquired through the cooperative sharing of risks of misfortune by groups, on the assumption that but a small proportion of the group is likely to encounter misfortune at the same time. Members of the group contribute to a single fund out of which sufferers are indemnified for losses. Corporations that function as insuring entities compute risks scientifically by actuarial calculation and from experience tables. Mutual companies and individual groups also function as the bearers of risks. In all cases the essential principle is cooperation. Losses are pooled in the expectation that through the working of the law of averages losses will occur to but a small number of the group. For instance, experience may indicate that but five out of every thousand ships will sink in a year although it is not known whose ships will go down. The loss to the companies owning the five would be devastating but when it is distributed among a thousand owners it becomes a minor amount of loss. There is nothing in insurance that prevents loss; it merely substitutes a small, certain loss for a possible or contingent loss. Payment is made for insurance protection periodically. Almost every human activity is now covered by insurance, the principal kinds of which are life, fire, marine, fidelity, health, sickness, liability, surety, accident, casualty, automobile, grain elevator, credit, war risk, burglary, robbery, plate glass, boiler explosion, fly wheel, baggage, parcel post, sprinkler leakage, lumber, household furniture, strike, windstorm, hail, cyclone, tornado, rain, hail, forgery, collision, ship hull, rent, use and occupancy and workmen's compensation. FIRE INSURANCE is written by stock companies, mutual companies or by associations of underwriters such as Lloyd's in London. LIFE INSURANCE is written by stock and mutual companies which are classified according to the plan of premium payments as old line or level premium and assessment, fraternal and mutual companies. *See also* ACCIDENT INSURANCE; AUTOMOBILE INSURANCE; COOPERATIVE INSURANCE; CREDIT INSURANCE; DISABILITY INSURANCE; ENDOWMENT INSURANCE; GROUP INSURANCE; HEALTH INSURANCE; MARINE INSURANCE; TRAVELERS INSURANCE; UNEMPLOYMENT INSURANCE; WORKMEN'S COMPENSATION.

INSURANCE MAN, a business man specializing in the operation of an organization dealing with life, fire, marine, casualty or other types of insurance against risks. Each of these fields of insurance can be viewed in terms of the kinds of operation involved: 1. The productive or agency work which is concerned with the procuring of business; 2. Executive or managerial concerned with the routine conduct of the business; 3. Actuarial or scientific concerned with determination of risks and 4. The underwriting of risks and the investment and care of funds involved therein.

The insurance business is generally entered as an agent procuring new business. The best way to qualify is to form the habit of learning the probable needs of a prospect so that the particular type of contract that best meets those needs can be offered. Some knowledge of the law will prove an asset, and an agent should understand the fundamentals of taxation, including inheritance taxation. Conversancy with the ordinary problems of finance and budgeting will also be of value.

Actuarial positions are filled by those who have made a special study of actuarial science, which is the science of the basic facts upon which insurance rates are made. Chief underwriters must have a special knowledge of all phases of the business and must be competent to evaluate the different types of risks that must be taken.

Fire and casualty insurance are property insurance, and the best start in this branch is to take almost any position in a head office, or in the office of a broker or agent where familiarity with rates, rules, forms and manuals can be gained by actually working with them. Marine insurance is a highly specialized field, covering all risks by sea.

In all branches of insurance every opportunity for training is offered to the man working in it. In many of the universities of the United States, courses of instruction are given in the several aspects of insurance. The Actuarial Society of America and the Institute of Actuaries offer fellowships, and other branches of insurance are represented by societies who offer special courses of instruction and issue certificates of competence. C. A.

INSURGENCY, in international law, a status of a community which, through insurrection having a political object, has seriously interfered with the sovereignty of the titular government and started a conflict of considerable proportions. Recognition of a state of insurgency does not result in a civil war, or in the extension to the insurgents of belligerent (*see* BELLIGERENCY) rights. Insurgency confers rights and obligations both on the parent state and on the insur-

gent community. Recognized insurgents are not to be regarded as pirates. Nor are unrecognized insurgents pirates, if the movement has a political and public end, rather than a private one to rob or plunder.

INSURRECTION, a rising against constituted authority with a view to effecting a public or political purpose. The term implies open and active opposition and forcible resistance of a number of persons to the execution of the laws, the orderly processes of government. Neither bloodshed nor probable success are necessary indicia of an insurrection; but to be dignified by that term, the rising, the opposition or the resistance must be of sufficient magnitude and force to defy for the time being the authority and agencies of government.

Under the Constitution and statutes of the United States, the President has authority to employ the Army and Navy and call forth the militia to suppress insurrection against Federal authority; and upon application of the proper state authority he may take like action to suppress insurrection against the government of a state. The Federal statutes prescribe that when it becomes necessary to employ military force to suppress insurrection "the President shall forthwith by proclamation, command the insurgents to disband and return peaceably to their homes within a limited time." E. A. K.

BIBLIOGRAPHY.—*Revised Statutes of the United States, Sections 5297-5300; Manual of Military Law,* The War Office, London; *U.S. Army Regulations, 500-50.*

INTAGLIO, in art, the opposite of *relief.* In gem-cutting, any design sunk below the surface of the stone is said to be in intaglio. In the graphic arts, intaglio processes are those, like etching and line-engraving on metal, in which the lines to be inked and printed are cut or bitten into the surface of the plate. White-line engraving on wood, although lines are incised in the block, is not an intaglio process, because such lines do not take the ink. Printing is accomplished from the parts left in relief. Matrices of signet rings and stamps are often cut intaglio in order that a seal impression may be in relief.

INTEGER, a Latin word meaning whole, and hence applied in arithmetic to whole numbers like 3, 7, 6, and 400, as distinguished from fractions, or broken numbers, like $\frac{2}{3}$ and $-\frac{4}{5}$ and from irrational numbers like $-\frac{1}{2}\sqrt{3}$ and $\sqrt[3]{17}$. *See* NUMBERS, THEORY OF.

INTEGRAL CALCULUS, a branch of what was formerly called the infinitesimal calculus. It is treated under CALCULUS.

INTEGRATION, that operation in the calculus which is the inverse of differentiation. That is, if we know that $y = \frac{1}{2}x^2$, then by differentiating we find that $\frac{dy}{dx} = x$. The inverse operation is to find the original function from which, by differentiation, we obtained this result. This process is integration. We represent it by the symbol $\int$; that is

$$\int \frac{dy}{dx} = \tfrac{1}{2}x^2.$$

But since the result of differentiating any constant is zero, so that the derivative of $\frac{1}{2}x^2 +$ any constant is $\frac{dy}{dx}$, we write

$$\int \frac{dy}{dx} = \tfrac{1}{2}x^2 + c,$$

where the constant c may have any value we please, it being known as the constant of integration. The conditions of the problem, however, usually allow for the finding of the value of c. *See* CALCULUS; DIFFERENTIATION.

INTELLECTUAL COOPERATION, INTERNATIONAL INSTITUTE OF. *See* INTERNATIONAL INSTITUTE OF INTELLECTUAL COOPERATION.

INTELLIGENCE, in psychology, the ability to adjust to a new situation. In its social significance and in its broader meaning, something of a social outlook ought to be included in it; intelligence is capacity for social experience. In its narrower meaning of mere ability to adjust, intelligence is purely logical in its methods; it simply seeks an effective end. In its broader meaning an ethical element is incorporated in the procedure. Here the interest is not only in the how of adjustment but in the how ought of the process. Intelligence is the seeking not only for an adjustment but for a better adjustment.

Intelligence thus represents the adaptive function of the organism. Many adaptations take place below the level of intelligence, but with the dawn of this function the process becomes much more of a conscious one. There is no hard and fast line between instinctive and intelligent behavior. The latter is an outgrowth of the former. Sub-human species manifest intelligence. Animal intelligence is well established by the results from comparative psychology. In this field intelligence has been approached from the standpoint of ability to learn by the trial and error method. Man apparently is the only animal who can use concepts, and in its highest form intelligence is expressed in this ability to use concepts. Since concepts are more flexible, they become short cuts in the learning or adjusting process. Ability to apprehend connections between things and ideas is also a manifestation of intelligence. The capacity for profiting by past experience is another index to intelligence. Running throughout these various conceptions of intelligence it will be noted that central to them all is the idea of adjustment.

A connection between means and ends is involved in the process of adaptation. Intelligence in this sense means an adjustment between the means and ends of activity. It sets up its own goal and then fashions the means for its realization. When the adjustment involves too great a discrepancy between means and ends it is not an intelligent one. War as a means of settling international disputes is not an intelligent method of adjustment. It means that intelligence has

become bankrupt when such a means has to be resorted to. It is the business of intelligence to prevent such a catastrophe, and although there may be much of it displayed at such a time in the narrower meaning of the word, in no sense is the activity in any way, shape, or manner intelligent. For a different type of discussion of the question of intelligence see ABILITY.

BIBLIOGRAPHY.—L. M. Terman, *The Measurement of Intelligence* (1916); E. L. Thorndike, *The Measurement of Intelligence* (1927).

INTERCHANGEABLE PRODUCTION. *See* PRODUCTION, INTERCHANGEABLE.

INTERCOLONIAL RAILWAY, from Halifax to Quebec, built by the Canadian Government in fulfilment of Article I of the BRITISH NORTH AMERICA ACT, 1867. Between the more thickly settled parts of Quebec and the Maritime Provinces was a long stretch sparsely settled; a railroad was needed to complete any political union. In 1848 Canada, Nova Scotia and New Brunswick had surveys made by Imperial officers. Several possible routes were reported upon, the one farthest north being recommended because it avoided United States territory entirely. The project was integrated with Confederation, construction to begin six months after union. The Imperial Government guaranteed a loan of £3,000,000. Commercial considerations demanded a more direct route, which would necessarily traverse a portion of United States territory, and the majority of the Macdonald ministry favored a line from the Riviere du Loup to St. John. SIR GEORGES CARTIER succeeded, however, in securing authorization of the northern route, touching Chaleur Bay. Absorbing portions of older railways, the Intercolonial was completed, 950 miles, in 1876. In 1918 it was merged into the Canadian National Railways System.

INTERDICT, in its restricted sense, is an ecclesiastical edict prohibiting the celebration of public worship, the administration of certain sacraments, Christian burial, etc. An interdict is local when applied to places; personal when directed against individuals or groups; and mixed when combining both characteristics. General interdicts embrace nations, provinces, towns or communities and may be imposed only by the pope; a particular interdict is confined to a certain diocese or parish, or to individuals mentioned by name, and is within the province of a bishop. An interdict may be imposed either as a censure or as a punishment. Its use may be traced back to the 6th century. During the Middle Ages it proved a more or less effective weapon of the Church in advancing its interests, particularly in the struggles between popes and secular rulers. Innocent III imposed an interdict on all France, when Philip Augustus divorced Ingeborg to marry Agnes of Meran. In his contest with Frederick II, Pope Gregory IX put Sicily under interdict for 60 years. In 1606 Paul V placed an interdict on Venice which lasted for a year. As late as 1909 Pius X imposed an interdict for 15 days on the people of Adria in northern Italy, after they had made an attack on their bishops as a protest against his change of residence to Rovigo.

INTEREST, in economics, payment for the use of capital, and for the waiting involved in the saving of capital. This definition, however, leaves much to be desired, for no subject in economics has been the area of more dispute and fogginess than has interest. Capital, whether thought of as instruments or as money and credit, purchasing power, is productive; a profit can be made by using it. In an industrial society men bid for capital because it enables them to make a profit from business or productive operations. On the other hand, those who possess capital, but do not care themselves to undertake the risks of productive or speculative business, take advantage of the fact that capital is productive and the use of it a valuable privilege, and accordingly charge for that use all they can get. Thus there is a demand for capital, a supply of it, and a market for it in which the rate of interest is determined by the interplay of demand and supply. Interest, therefore, is a price. From the standpoint of demand for capital, interest may be regarded as commuted PROFITS. From the standpoint of the supply of capital, interest is a withholdal price exacted by those who possess one of the requisites to production—capital. How they happen to possess capital is a matter of social and individual history, of inheritance, thrift, industry, luck and private property. The same is true of the ownership of any form of wealth, of which capital is only one. Therefore, orthodox economists have always sought to explain and justify the charging of interest on some other basis than merely of what the traffic will bear. The existence of capital, or of a loan fund, it is argued, is evidence that some one has saved, that is, has not spent all his income on current consumption. Saving involves abstinence or waiting, which is a sacrifice because people naturally prefer to satisfy present wants rather than wait for the satisfaction of future wants. Present wants loom larger than future wants. Hence people will not save, at least a sufficient amount to fill the needs of industry, unless they are paid for so doing. Another theory, however,—J. B. Clark's—holds that only additions to capital involve waiting and that the main explanation of interest is to be found in the productivity of capital. A. B. W.

INTEREST, TRANSFERENCE OF, the change of interest from one object to another. In a normal interest situation, there is a desired object, i.e., one to be realized. Psychologically, we are not interested in the things we have; we simply enjoy them. Interest represents a state of desire, and for this desire to be genuine there must be some effort exerted on the part of the individual to attain the object of interest. The feeling content, which helps to hold attention and concentrate effort on the object of interest, is also involved. In the transfer of interest one object has been substituted for another. Transference may also take place upon the realization of the object of interest. Much learning consists in the transfer of

interest. The conditioned reflex is the basis for such transference.

INTERFERENCE, RADIO, a term loosely applied to anything other than the desired program that becomes audible in received radio signals (*see* ELECTROMAGNETIC WAVES). Sometimes the term is used to refer to the source of interference. The word is also restricted to mean the disturbances of a man-made nature, as opposed to natural STATIC. *See also* ATMOSPHERICS.

INTERFERENCE OF LIGHT, the effect produced when two waves (*see* LIGHT) pass through a medium at the same time, the resulting motion being a combination of the two. There is no field in which this proportion of wave motion is better shown than in light. Two waves meeting at a point may neutralize or assist each other in whole or in part, so that in any given medium, two sets of waves will thus set up an interference pattern. To permit observation, the relationship between the two waves must remain fixed. In light phenomena, this relationship can be maintained only when two waves come from the same source. To furnish two waves which come from the same source, a beam is divided and the two portions are made to travel different paths to the same point. A good illustration is the Michelson INTERFEROMETER.

INTERFEROMETER, an instrument which applies the interference (*see* INTERFERENCE OF LIGHT) between two beams of LIGHT to measure small displacements, distances, WAVE-LENGTHS of light and indexes of REFRACTION, to analyze spectral lines (*see* LINE SPECTRUMS) and to make other precise measurements.

Of the various types of interferometers, probably the most common form is that invented by MICHELSON.

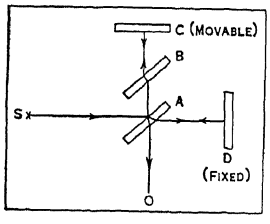


FIG. 1
MICHELSON INTERFEROMETER

In Fig. 1, light from a source, *S*, separates into two beams at the front surface of *A*, a plate of glass with parallel sides, which is half-silvered on the side toward *S* so that half of the incident light is reflected and half transmitted. The part transmitted passes through *A*, strikes the fixed mirror, *D*, normally, and is reflected back on its path to *A*, where part of it is reflected to the observer at *O*. The light from *S*, reflected at the front surface of *A*, strikes the movable mirror, *C*, normally, then retraces its path back to *A*, where part of it is transmitted and reaches *O*. Here, the two interfering beams produce curved, alternate light and dark bands called *interference fringes*, which are observed by the eye, with or without the use of an observing TELESCOPE. The purpose of the glass plate, *B*, which is of exactly the same thickness and form as *A*, is to equalize the two optical paths, for, without it, the light-path, *SADAO*, would traverse the glass, *A*, three times before reaching *O*, whereas the path, *SACAO*, would pass through glass only once.

The mirror *C* is held in a metal frame which can be moved along accurately ground ways by means of a screw, the motion of which can be controlled and measured accurately. In adjusting the instrument, a pin is placed between the source, *S*, and the plate, *A*, whereupon two images, one formed by each beam, are seen at *O*. These are made to coincide by adjusting the mirrors, *C*, and *D*, and interference fringes appear at *O*, provided the light source at *S* is homogeneous, e.g., a sodium flame or a mercury arc. If white light is used at *S*, the fringes will appear only when the optical paths, *SACAO* and *SADAO*, are equal. Suppose that λ be the wave-length of the light source, and that a black band be focused upon the cross-hairs of the observing telescope. If the mirror, *C*, be slowly moved out a distance, $\frac{1}{2}\lambda$ the light path, *SACAO*, will be increased by a whole wave-length, λ, and the observer at *O* will see the fringes shift, an adjacent black band taking the place of the original one. Thus, by counting the number of fringes which pass when the mirror, *C*, undergoes a given displacement, this displacement can be measured in terms of the wave-length of the light used, or vice-versa, if the displacement is known accurately, the wave-length, λ of the light can be obtained.

Since the wave-lengths of spectral lines are invariable, it seemed desirable to obtain an evaluation of the standard meter (*see* METRIC SYSTEM), i.e., the distance between two lines ruled on a bar of platinum-iridium alloy, expressed in terms of some standard wave-length of light. The standard could then be reproduced, even though the bar should be damaged or destroyed. Michelson measured this distance in 1892 and found that, at 15°C. and normal atmospheric pressure, the standard meter contains 1,553,163.5 wave-lengths of the red line of cadmium, the accuracy of this measurement being of the order of one part in two million.

The interferometer is of great importance in investigating the character of a spectral line. If the line is a doublet, each component will produce its own set of fringes, and as the mirror, *C*, is moved slowly outward, these two systems of fringes will coincide at some positions and will annul each other at other positions; hence, the "visibility" of the fringes will vary as *C* is moved. The visibility curves thus determine whether a line is a singlet, a doublet, or of still more complicated structure.

A second form of interferometer, developed by Fabry and Perot, consists of two parallel, half-silvered, glass plates, the distance between which can be varied. In this interferometer, interference fringes are produced by the multiple reflections between the plates.

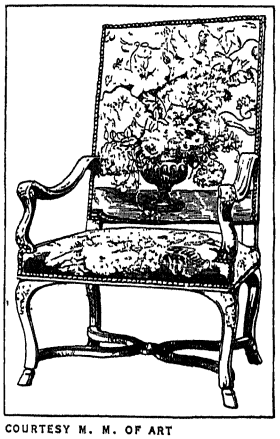
A third form of interferometer, developed by Lummer and Gehrke, consists of a plate of glass with a right-angled prism cemented to it near one end. The incident light enters the plate through this prism and passes diagonally down the plate, being reflected back and forth many times. At each reflection, part of the light gets out, these beams producing interference fringes.

T. S.

INTERGLACIAL STAGES, the intervals between successive ice sheets in a glacial age, during which warmer weather prevails, and the ice consequently melts from the land. Such stages are marked by the accumulation of soil between successive glacial deposits. *See also* GLACIAL PERIOD; GLACIATION; ICE AGE; BOULDER CLAY.

INTERIOR DECORATION, the art of furnishing and decorating the interiors of a building according to the principles of proportion, symmetry, line and color. Its aims are both comfort and beauty and in every epoch utilitarianism and aestheticism have been predominant in varying degrees. The decoration of domestic interiors is one of the oldest of the arts, and has always been a function dependent upon architecture itself. Cabinetmaking, rug-weaving, painting, sculpture, pottery and many other arts and crafts form its endlessly varied elements.

Except for their mural paintings and sculptures the early interiors, through medieval times down to the Renaissance, were undecorated, of a purely utilitarian character, directly reflecting the climatic conditions of the country. Rooms with stone floors, massive doors and mere slits of windows testified to a need of protection from the cold and from possible attack. The sparse furniture was of heavy oak, and textiles and utensils were of a hardy, rough character.



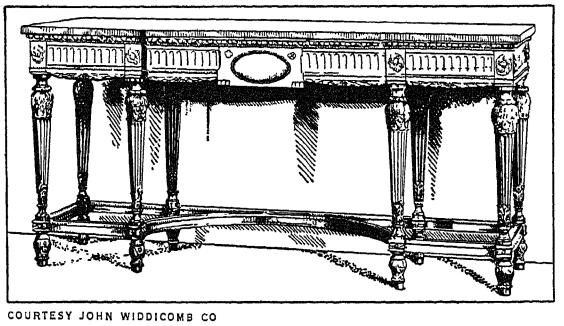
COURTESY M. M. OF ART

FRENCH CHAIR OF THE LOUIS XIV PERIOD

With the dawn of the Renaissance the decorative arts, as well as all others, attained to a more conscious growth. Rich stuffs, heavily carved furniture, fine paintings and gesso work adorned dwellings as well as churches and other public buildings. In England and France interior decoration followed widely separate ways, reflecting the ever-changing characteristics of the people and the times. The result was interiors so distinct in every detail that examples which exist to-day are distinguishable at once as belonging to a certain period.

In France during the 17th and 18th centuries interior decoration flourished in all its branches. Under Louis XIV baroque decoration reached its peak. The Gobelins tapestry factories produced their finest pieces and the great artists of the time decorated the walls and ceilings of the royal palaces. Carved and gilded furniture, beautifully mounted with brass and ormolu, filled the drawing-rooms of the period. With the ascent to the throne of Louis XV, designs became more extravagant, textiles were richer and the *décor* assumed a pronounced femininity, directly in keeping with the artificiality of society at the time. It was the age of the rococo style, of curving line and ornate decoration. Charles André Boule was the most famous designer of the 18th century in France, and his beautiful cabinets and commodes are reproduced to-day.

A slight change marked the interiors of the Louis XVI period. Inspiration was becoming somewhat attenuated and richness and extravagance could not conceal the lack of freshness and originality in design. Fine marquetry and *boiseries* of all kinds were popular and textiles and furniture coverings were increasingly

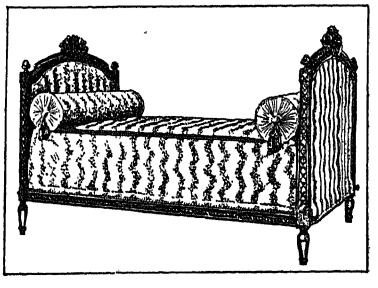


COURTESY JOHN WIDDICOMB CO

FRENCH CONSOLE, LOUIS XVI PERIOD

luxurious, with smaller, spaced patterns. With the Directoire and the Empire, neoclassicism supplanted the rococo style and continued well into the 19th century. Architectural themes played an important part in decoration, furniture became more severe in design and highly stylized motifs replaced the floral patterns favored by the Louis.

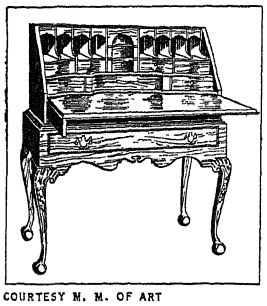
In England the sturdy Tudor interiors gave way to the fine tapestries and heavy carvings of the so-called Jacobean period. Decoration was far more sober in tone than in France and colors were rich but



BED OF THE LOUIS XVI PERIOD

somber. In the late 17th century the William and Mary style introduced its suites of narrow, high-backed chairs and settees. Construction was somewhat lighter and caning and rush-work were used along with the already popular tapestry, needlework and brocade. The paneled rooms of the Queen Anne and Georgian periods were particularly successful and the best work of the 18th century in England remains unsurpassed. Between 1749 and 1799 Chippendale brought his genius to the designing of furniture, working mostly in walnut and mahogany. His least successful pieces belong to the highly artificial Chinese style which was

immensely popular for a time. Sheraton and Hepplewhite were the master craftsmen of a somewhat later period, and though completely different both their styles show an increasing simplicity of conception. To the 18th century also belongs the classic revival in England, of which the brothers Adam were the chief exponents. The year 1762 marked a turning point in taste in decoration. Then Robert Adam, the first great modern architect, first applied architectural motifs to interior decoration, treating the room and its furnishings as one. Especially designed classic furniture was placed against a background of columns, entablatures, medallions and symmetrical designs. The finest work of the Adam school produces an effect of harmony and serenity unlike that of any other style.

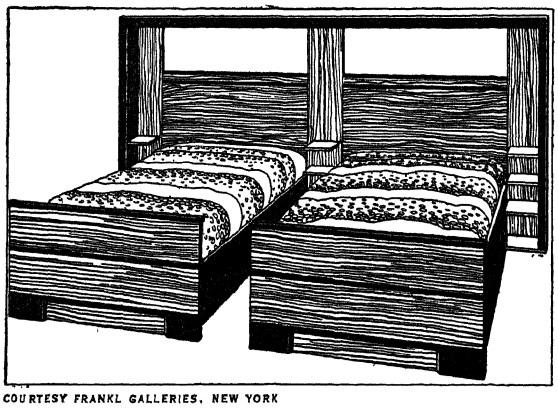


COURTESY M. M. OF ART

AMERICAN WALNUT DESK, INLAID, WITH CARVED CABRIOLE LEGS

From about 1840 decorative art began to wane, few designers of note appeared and the process of standardization in furniture and decoration set in. The long gap until the present day was bridged with tasteless and overelaborate makeshifts. Rooms were poorly designed and overcrowded and, in spite of various abortive attempts to create or revive certain styles, proportion and beauty of line were forgotten.

To-day a new type of architecture and interior decoration is springing up. In Germany, France and somewhat less in England and America decorative schemes based on mechanistic forms are taking the place of the traditional ones. Interesting experiments are being made by such men as LeCorbusier in France and Walter Gropius in Germany. The basis for this architecture is the use of reinforced concrete both for domestic and public buildings. Simplicity, even severity, is the keynote of the decoration which employs metals, woods, glass, leather and various compositions to achieve its effects. LeCorbusier's theory of a house as "a machine to be lived in" is being worked out on the principles of hygiene, utilitarianism and reasonable comfort. Line and material have taken the place of ornamentation for its own sake. The designer draws his inspiration from the lines of the skyscraper, the airplane and the streamline motor car. The new school believes that grace and beauty lie in the elimination of the unnecessary and, though often everything is sacrificed to originality, these designs are fair indications of the interior decoration of the future. The sparsely furnished flat with sliding doors, glass walls and built-in furniture is as typical of this era as were the bric-a-brac cabinets and cozy corners of the Victorian age.



COURTESY FRANKL GALLERIES, NEW YORK

PAIR OF OVER-SHELF BEDS IN CONTEMPORARY DESIGN
Constructed of mahogany with black lacquer trim

BIBLIOGRAPHY.—F. A. Parsons, *Interior Decoration, Its Principles and Practice*, 1915; E. Holloway, *American Furniture and Decoration*, 1928; M. S. Adams, *Modern Decorative Arts*, 1930.

INTERIOR DECORATOR, an artist who designs interiors of houses or buildings. Knowledge of historical periods in furniture, of fabrics, woods, light and color are part of his equipment. A good decorator combines creative imagination with business judgment and executive ability. He must have individuality based on discriminating taste, to be successful in this field.

INTERIOR DEPARTMENT OF UNITED STATES. Under the Secretary of the Interior, the Department of the Interior has charge of a variety of enterprises ranging from the General Land Office to the operation of the Alaska Railroad. Within the broad scope of the department also fall the management of the Bureau of Reclamation, Geological Survey, Office of Indian Affairs, Office of Education, National Park Service and various hospitals and charitable institutions in the District of Columbia. The personnel of the department includes the Secretary of the Interior, two assistant secretaries, a chief clerk and a commissioner or director for each of the divisions above mentioned. Under the 1920 law, superseded in 1930, the Secretary was an ex-officio member of the Federal Power Commission. He is chairman of the Federal Oil Conservation Board, member of a committee on the public domain and of the National Forest Reservation Committee. In his custody since 1919-20 have been the records and files of the Fuel Administration and the Bituminous Coal Commission. He exercises also certain powers in relation to the territories of Alaska and Hawaii. S. C. W.

BIBLIOGRAPHY.—*Report of the Department of the Interior; Congressional Directory*, 1931.

INTERIOR TRIM. *See* MILL WORK.

INTERLAKEN ("between the lakes"), a Swiss town beautifully situated in the valley of the Aar between lakes Thun and Brienz, 26 mi. southeast of Berne. The place is visited annually by thousands of tourists, who enjoy the wonderful views of the Jungfrau, Mönch and the Bernese Alps, and make it their starting point for reaching other charming places in the mountains. There are many hotels, a fine old castle, and an Augustinian monastery, founded in 1130. Est. pop. 1928, 4,500.

INTERLOCKING. *See* RAILROAD SIGNALING AND INTERLOCKING.

INTERLUDE, in the early ENGLISH DRAMA, a light dramatic piece played between the acts of the morality or mystery plays, or presented during elaborate court entertainments. More specifically it was the short and coarsely farcical play developed by JOHN HEYWOOD (d. about 1580). The interludes of Heywood presented situations and characters from real life, not symbolical scenes and abstract characters as had the morality plays. They were a long step forward in the drama and paved the way for the English comedy. Heywood's best known interludes are *The Four P's, The Play of Love,* and *The Mery Play Between Johan the Husbande, Tybe the Wyfe and Sir Jhon the Preest.*

BIBLIOGRAPHY.—A. W. Pollard, *English Miracle Plays, Moralities and Interludes,* 8th ed. 1927.

INTERMEDIATE FREQUENCY, a FREQUENCY above the audible frequency (*see* AUDIO FREQUENCY), but below frequencies commonly employed for radio transmission (*see* ELECTROMAGNETIC WAVES). Specifically, it is the frequency to which the fixed frequency amplifier of a SUPERHETERODYNE radio receiver is tuned. *See also* RADIO RECEIVER.

INTERMOLECULAR FORCES. *See* SOLID STATE, THEORY OF; COHESION.

INTERNAL COMBUSTION ENGINES convert the chemical energy of a fuel into mechanical energy by mixing it with air and exploding the mixture in a working cylinder against a piston head. They may be either single acting, in which only one end of the working cylinder is employed as a combustion space, or double acting, in which both ends are so employed. Both of these types may operate on the two- or four-stroke cycle. In the two-stroke cycle operation, combustion occurs in each cylinder once every revolution of the crankshaft; in the four-stroke cycle operation, it takes place once every two revolutions. *See also* GAS ENGINE; OIL ENGINES.

INTERNAL GEARS. *See* GEARS AND GEARING.

INTERNAL REVENUE, revenue received from duties and taxes other than CUSTOMS DUTIES. When the Federal Government of the United States was established Congress was given, unconditionally, all the indirect taxes, that is, the customs duties and excises. But the direct taxes, that is, taxes on property and on persons were practically reserved to the states. The indirect taxes, constituting thus the chief revenues of the Federal Government, fell rather naturally into two great classes: The customs duties which were thought of as external or boundary taxes, and the excises which were levied on goods produced within the country. The latter came by common usage to be designated as internal revenues. With the passage in 1913 of the constitutional amendment permitting Congress to levy income taxes the term internal revenue fell somewhat into disuse. Yet, of course, it may well be applied to cover all taxes, excises, income inheritance and others, levied by Congress other than the customs duties. In official reports this convenient classification of internal revenue is still used. But the importance of the INCOME TAX and its separate administration tends to separate it from the older internal taxes.

Among the older taxes, which seem by tradition to have the first claim to be called internal, those which have in the past yielded the most revenue are the taxes on alcoholic beverages and those on tobacco. With the coming of prohibition, and the outlawry of alcohol as a beverage, the revenues from this source were reduced and only alcohol used for medical purposes remained. But the taxes on tobacco continued to be very productive and heavy on the users. This burden is not considered objectionable because tobacco is not thought of as a necessity and its use merely a habit of debatable wisdom.

Among the other internal taxes there have been many imposed in war times, and afterwards repealed. Thus, in connection with the Spanish War there were taxes on bankers, brokers, theaters and other amusements, stamp taxes on documents, on bank checks, on telegraph and telephone messages, taxes on patent medicines, toilet articles, chewing gum and many others. The multitudinous taxes of this sort introduced during the World War were afterwards materially reduced in number. *See also* TAXATION.

C. C. P.

INTERNAL REVENUE, BUREAU OF. Headed by the Commissioner of Internal Revenue under the supervision of the fiscal assistant secretary of the treasury of the United States, the Bureau of Internal Revenue has charge of the assessment and collection of all internal revenue taxes and the enforcement of internal revenue laws. Intelligence agents, tax agents and supervisors of accounts and collections are attached to the various units in the Bureau, on the income tax, miscellaneous taxes, accounts and collections and the general counsel's office or the legal branch. The two main divisions of the field service are the collection service and the field audit service.

BIBLIOGRAPHY.—*Report of the Bureau of Internal Revenue; Congressional Directory,* 1931.

INTERNATIONAL ADVERTISING ASSOCIATION, THE, an international business organization maintained by advertisers and business men for the purpose of promoting the best interest of ADVERTISING. The territory of the association is divided into 18 districts, representatives from each district meeting once a year to discuss district problems.

INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES, a bureau whose duties comprise keeping and preserving the international prototypes of the meter and the kilogram (*see* METRIC SYSTEM); periodically comparing the several national standards with the international prototypes; and supplying prototypes to the nations maintaining it. The Bureau is located near Sevres, France, in an observatory. The management of the Bureau is in the hands of the International Committee of Weights and Measures. It is financed by contributions from the various countries, the amount provided by each being

based upon its population and the extent to which it uses the metric system. In the observatory are kept the instruments used in the determination of the international standards such as the COMPARATORS, BALANCES and thermometers.

The International Bureau of Weights and Measures came about as a result of the need for uniform standards of weight and measure throughout the world. Its establishment was proposed at the meeting of the International Committee on Weights and Measures at Paris in 1872 and was later definitely decided upon at the international diplomatic conference of 1875.

INTERNATIONAL CONFERENCES, meetings of specially accredited representatives of national states for the consideration of important questions of mutual interest. A state may normally have more than one representative but not more than one vote. Decisions are subject to ratification by the proper agencies of the several states. As the growing interdependence of states gives rise to new problems, and more rapid means of transportation makes such meetings more feasible, the conference method is coming to be increasingly employed.

INTERNATIONALE, THE, the marching song of the international Socialist Labor movement, written in French in 1871 by Eugène Pottier and sung to a melody composed by Adolf de Geyter, of Lille. It has since been adopted as the characteristic hymn of all radical and revolutionary groups, performing in this respect the same function as the *Marseillaise* during the French Revolution. It is the national hymn of the Union of Socialist Soviet Republics.

INTERNATIONAL EDUCATION, INSTITUTE OF, established in 1919 in New York City by the Carnegie Endowment for International Peace. The founding of this institute was a direct outgrowth of the World War which awakened tremendous interest among Americans in foreign nations and international affairs. Its aim is "to develop international good will by means of educational agencies and to act as a clearing house of information and advice for Americans concerning things educational in foreign countries and for foreigners concerning things educational in the United States." The institute arranges for exchanges of professors between America and other countries, paying a portion of their expenses, administers fellowships provided by other organizations, and extends valuable services to official visitors studying American educational methods.

INTERNATIONAL FALLS, a city on the northern boundary of Minnesota, in Koochiching Co., situated on Rainey River, 104 mi. northeast of Bemidji. Three railroads, an interurban railway and bus lines afford transportation. Lumbering and farming are carried on in the vicinity. The city has newsprint paper and lumber industries. The countryside is attractive and popular as a summer resort. International Falls was incorporated in 1909. It was formerly known as the village of Koochiching. Pop. 1920, 3,448; 1930, 5,036.

INTERNATIONAL FEDERATION, the political union of a number of states involving the establishment of a Federal government for certain purposes and the surrender to this government, by the member states, of powers essential to the accomplishment of such purposes. At one time or another the federation of Europe has been advocated. M. Briand, foreign minister of France, made such a proposal in 1931. World federation has also been advocated as a means of preventing war and promoting the common interests of all nations.

INTERNATIONAL INSTITUTE OF AGRICULTURE, with central offices in the Villa Umberto I, Rome, Italy, has for its objective the collection, collation and publication of scientific information, statistical, technical and economic, on agriculture and rural life of all nations. Some 70 nations, representing 98% of the world's population, are represented by delegates on the Permanent Committee.

The Institute is the realization of the plan of an American, David Lubin, for an international clearing house of agricultural information. The King of Italy cordially recommended the plan in Jan., 1905—a conference of delegates from 40 nations was held in the following May, and on June 7 a treaty was signed providing for an institute to function for farmers as a kind of agricultural league of nations. Since 1908, the Institute with its secretariat, library and legislative sections has been housed in a palatial building provided for by grant of Italy, and from membership fees.

During the past few years serious question has arisen over the control of the Institute. In accordance with the terms of the treaty of 1905, the General Assembly of national representatives specified the policies to be executed by the Permanent Committee, or delegates. It would seem that local politics have gained control to a regrettable extent and that while the Institute deals with international data it is controlled by one nation to such an extent that the United States Government supports the Institute barely on terms of its initial aid in 1905. O. S. M.

BIBLIOGRAPHY.—A. Hobson, *The International Institute of Agriculture.*

INTERNATIONAL INSTITUTE OF INTELLECTUAL COOPERATION, an organization established in conformity with the covenant of the LEAGUE OF NATIONS to discover how international intellectual relations might be simplified and clarified. Certain intellectual cooperative bodies had been in existence before the World War, though these were not truly international, but in 1922 the Assembly of the League appointed the International Committee on Intellectual Cooperation. In 1924, France advanced funds for the founding of the Institute, which was inaugurated, Jan. 1926, with its headquarters in Paris. The institute aims to improve the pecuniary situation and legal status of intellectual workers, to this end supporting intellectual workers' unions and protecting copyrights. It also acts as a liaison and information center for everything which concerns international in-

tellectual relations. The publications of the institute—museum handbooks, holiday courses and university exchanges in Europe, and notable books published in French, English and German—are significant of the service it renders. As a foundation for later activities, the institute is collecting statistics for intellectual agencies.

Forty-four governments are represented at the institute: Argentine, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, Cuba, Czechoslovakia, Denmark, Dominican Republic, Egypt, Ecuador, Esthonia, Finland, France, Germany, Greece, Guatemala, Haiti, Hungary, Irish Free State, Italy, Luxembourg, Mexico, Netherlands, Nicaragua, Panama, Paraguay, Persia, Peru, Poland, Portugal, Rumania, Salvador, Spain, Sweden, Switzerland, Uruguay, Venezuela and Yugoslavia.

INTERNATIONAL JOINT COMMISSION, a commission of six members, three appointed by the President of the United States and three by the British crown on recommendation of the Canadian government. It has jurisdiction in cases involving the use of boundary waters between the United States and Canada, and is the authoritative body to hear questions affecting the interests of the two countries along the international boundary.

INTERNATIONAL LABOR ORGANIZATIONS. *See* LABOR ORGANIZATIONS.

INTERNATIONAL LANGUAGE, a form of speech artificially created to serve as a medium of intercommunication between persons of divergent native tongues, primarily for auxiliary use rather than to replace any existing national language.

An international language must be so constructed as to be easily acquired, and must therefore have a simple grammar and a vocabulary based on roots common to as many languages as possible. Two general types have been proposed: aprioristic, which are purely artificial and quasi-philosophical constructions on a hypothetical foundation of "natural" languages; and aposterioristic, which are based upon the principal existing European tongues. There are likewise defenders of LATIN, the international language of the Church and of learning throughout Europe during the Middle Ages, as the universal auxiliary speech, as well as of FRENCH, the general diplomatic language, and of GERMAN and ENGLISH because of their commercial importance. Specific modern tongues, however, are regarded as excluded because of possible complications due to nationalistic prejudices; and it is felt that an universal auxiliary language must be neutral.

The feeling of need for an international language goes back at least to 1629, when RENÉ DESCARTES criticized one that had been submitted to him and outlined another of his own, this, like all proposed before 1765, being aprioristic in type. The first completely aposterioristic system appeared in 1839; and since that time more than 300 international languages have been proposed, of which Volapük, Esperanto, Latino sine flexione or Interlingua, Occidental and Novial (*see* separate articles on these subjects) are the most important, others, such as Mundolingue, Ro, Universala, Romanol, etc., having gained little acceptance. H. S. E.

BIBLIOGRAPHY.—L. Couturat and L. Leau, *Histoire de la langue universelle,* 1903; A. L. Guerard, *A Short History of the International Language Movement,* 1922; P. E. Stojan, *Bibliografio de internacia linguo,* 1930.

INTERNATIONAL LAW, the term applied to the body of rules recognized as governing the relations of states or other bodies which possess an international personalty. It should be distinguished from diplomatic policy, and from international comity and morality. If not contrary to national legislation, international law is generally considered to be a part of the law of the land of each state.

Unlike national law, which consists of rules laid down by a superior power, international law is based upon agreement between the subjects of law, that is to say, the states themselves. This agreement may be expressed—in the form of treaty, or implied—in the form of custom. The existence of a rule is evidenced by TREATIES, deliberations of international conferences, decisions of international tribunals, official acts of states, decisions of national courts, and finally the writings and opinions of statesmen and jurists.

While some international law existed in ancient times, and reached a particularly advanced stage among the Greek city states, it was of slight importance in Rome and declined toward the vanishing point during the Middle Ages. The *sine qua non* of international law is the existence of independent states enjoying a certain minimum of stability, culture and civilization, and carrying on with each other a certain degree of mutual relations. These conditions did not exist until the Peace of Westphalia, 1648, and this date is generally accepted as fixing the birth of modern international law.

The evolution of international law may be seen as a compromise between the exigencies of selfish policy on the one hand, and the demands of justice and morality on the other. States have never quite lowered themselves to follow MACHIAVELLI completely, nor have they, on the other hand, harmonized their policies with the principles of natural justice taught by GROTIUS and Pufendorf. The right of conquest, considered legitimate in international law, was a victory for Machiavelli, while the rule forbidding the slave trade and making it piracy, consecrated during the 19th century, was a triumph for natural justice. From another point of view, international law is a compromise between the doctrine of the exclusive sovereignty of states, even to-day the greatest obstacle to progress, and the conviction that there can be no legal order, stability or peace until states have surrendered to the collectivity a certain degree of their liberty of action.

The development of international law was profoundly influenced by the writings of certain jurists, the acts of great international conferences, and by

certain major events or policies The most important of these jurists were Gentilis (1551-1608), Grotius (1583-1645), Zouche (1590-1660), Pufendorf (1632-1694), Vattel (1714-1767), and von Martens (1756-1821). The most important conferences were: Peace of Westphalia (1648), Peace of Utrecht (1713), Congress of Vienna (1815), Declaration of Paris (1856), London Conference (1871), Brussels Conference (1874), Berlin Congo Conference (1884-5), Hague Peace Conferences (1899 and 1907), London Naval Conference (1909), Versailles Conference (1919), Washington Naval Conference (1922), Locarno Conference (1925), and London Naval Conference (1930). The following had a major influence upon the development of the law of nations: Armed Neutrality (1780 and 1800), the movement for colonization and imperialism, the growth of nationalism, French Revolution, Napoleonic Wars, Holy Alliance (1815), Balance of Power, Concert of Europe, Monroe Doctrine, the growth of the INTERNATIONAL UNIONS, especially the Universal Postals Union (1874), the development of modern arbitration (particularly through Jay Treaty (1794), Albany Claims Arbitration (1872), League of Nations system, PERMANENT COURT OF INTERNATIONAL JUSTICE, and obligatory arbitration treaties before the WORLD WAR), World War, and finally the founding and development of the LEAGUE OF NATIONS.

International law is ordinarily divided into the law of war and the law of peace. During the first centuries of its modern development, the law of war was the more important, comprising as it did the rules of NEUTRALITY, BLOCKADE, CONTRABAND, VISIT AND SEARCH, and laws destined to alleviate suffering in time of war. These rules played an important part in the diplomatic history of the 18th and 19th centuries in particular, as is shown by the Prize Court decisions and certain great arbitration cases such as the Alabama Claims case. But the absence of an impartial tribunal to apply and interpret these rules, and the lack of a sanction to enforce them, have had unfortunate consequences. In time of stress, especially during a desperate world war, nations are inclined to follow the dictates of policy rather than law. Nevertheless the greater part of the laws of war are observed, and violations are often followed by retribution in the form of the award of damages at the end of the war. Since the World War, statesmen and jurists have been more interested in the development of international machinery and rules for the OUTLAWRY OF WAR than in studying the laws applicable when war breaks out. The Covenant of the League and the Briand-Kellogg Pact are inspiring much more interest than the proper definition of contraband or the exact limitations of the blockade. This is well illustrated in the evolution of the law of neutrality. Before 1914 the main emphasis here was upon the duty of impartiality owed by the neutral toward the two belligerents. To-day the major effort is the search for a workable method for determining the justice of war, and to identity of the aggressor. Instead of asking of the neutrals an attitude of indifference, the new conception would require them, in the interests of peace, to bring pressure to bear upon the wrong-doing state. If this effort succeeds, it may mean the end of neutrality.

The so-called international law of peace controls the every-day relations of states. These laws are almost universally obeyed, and control situations and relations almost too numerous and varied to be visualized. Under the law of nations, the states are classified and defined, their admission into the family of nations through RECOGNITION, carefully regulated, and the acquisition and transfer of territory controlled. The intercourse of states is governed by the laws concerning the privileges and immunities of diplomatic agents and consuls, and the making, interpretation and application of treaties. The beginnings of an international judiciary are found in the rules for submission of disputes to INTERNATIONAL ARBITRATION and judicial settlement. The existing international community could hardly carry on for a day if deprived of its legal basis, the rules of international law.

Unfortunately the law of peace, like the law of war, suffers from serious lacunae. For certain situations international law has developed no adequate rules, and thus leaves gaps which come under the category of "domestic questions" and "non-justiciable disputes." Serious efforts, through codification and conference, are being made to fill in these gaps. A second defect is the reluctance of states to submit their disputes to the rule of law. They are reluctant also to surrender their independence of action, and here again the doctrine of the exclusive sovereignty of states is a serious obstacle. Another defect is the absence of effective methods for securing the enforcement of the law. As long as great states may disobey the law with impunity, there can be no final stability, no lasting peace. The force of public opinion has immense influence in this matter, but it is still inadequate. Sanctions have been developed by the League of Nations, but they apply only to certain narrow situations, and their operation is still untried, and the plan suffers from a number of outstanding defects. In short, international law is still far distant from the stage which national law has reached; it may never achieve the same measure of progress. J. B. W.

BIBLIOGRAPHY.—J. L. Brierly, *The Law of Nations*, 1930; A. S. Hershey, *The Essentials of International Public Law and Organization*, 1927; C. C. Hyde, *International Law Chiefly as Interpreted and Applied by the United States*, 1922; L. Oppenheim, *International Law, a Treatise*, 1928.

INTERNATIONAL LAW, PRIVATE. *See* CONFLICT OF LAWS.

INTERNATIONAL PAYMENTS, payments made when the citizens or the government of one country cancel an obligation incurred by them in favor of the citizens or the government of another country. Ordinarily, funds are not actually transferred. The common method of making a payment from one country to another is through the use of BILLS OF EXCHANGE. These are CREDIT instruments and are usually balanced against one another, those

requiring payments to a country against those requiring payments from a country, just as are checks in clearing house operations, thus obviating the necessity of the actual transfer of funds in the form of GOLD or otherwise. For example, exports from the United States give it claims against foreign nations; imports give them claims against it. To the extent that these claims are equal one will offset the other so that payment may be made without the use of actual money.

The sum total of the payments due to a country and the payments due by that country are frequently referred to as that country's balance of payments. Following is an abbreviated form of the balance of payments of the United States for the year 1929. (The obligations that require transfers inward should be equal to those that require transfers outward. Their difference is due to inavoidable discrepancies in collecting the data.)

INTERNATIONAL PAYMENTS OF THE UNITED STATES, 1929 (IN MILLIONS)

	Inward	Outward
Exports and imports proper ..	$5,241	$4,400
Other commodity trade	249	356
Gold	245	365
Total visible items	$5,735	$5,121
Private, long-term capital	$2,405	$2,791
Earnings of private investments..	976	414
Tourists' expenditures	274	839
Freight payments	154	269
Immigrants' remittances	24	247
U. S. War-debt receipts	212	5
Minor invisible items	265	368
Total invisible items	$4,310	$4,933
Grand total	$10,045	$10,054

See also BALANCE OF TRADE; FOREIGN EXCHANGE; EXPORT OF CAPITAL; EXPORTS AND IMPORTS. A. F. L.

BIBLIOGRAPHY.—U. S. Bureau of Foreign and Domestic Commerce, *The Balance of International Payments of the United States,* 1929.

INTERNATIONAL PEACE BRIDGE, an arched bridge over the Niagara River, connecting the United States at Fort Porter, Buffalo, N.Y., with Canada at Fort Erie, Ontario. The structure was completed in 1927, and formally opened following the meeting on the bridge of Vice-President Dawes and the Prince of Wales. The structure is 4,250 ft. in length, and consists of 5 steel arches resting on granite-covered concrete piers, supporting a roadway 36 ft. wide. At the Buffalo end of the bridge is a Parker truss-span of 360 ft. spanning the entrance to the Black Rock Ship Canal, at which point the roadway is 100 ft. above the water. The roadway slopes gradually toward the Canadian shore down a 2.75% grade. The structure was completed in one year at a cost of $4,000,000. Traffic capacity is 3,000 vehicles an hour.

INTERNATIONAL TRADE ASSOCIATIONS AND CONGRESSES, organizations to protect and promote the interests of the trade, industry or profession with which they are concerned. The first regular international association, the International Working Men's Association, was formed as a result of the International Exhibition in London in 1862. Within a few years following this date numerous other international congresses were held and associations formed. The various world associations and congresses were broken up temporarily by the World War, but afterwards were renewed in increased numbers and with more intense activity. When the League of Nations was formed, all international governmental organizations were placed under its direction and it was decided that international private organizations could be placed under the direction of the League upon their consent. Examples of international association are the International Institute of Agriculture and the International Chamber of Commerce; of international congresses, the World Power Conference and Congress of the International Chamber of Commerce.

INTERNATIONAL UNIONS. The World War destroyed about one-half of the pre-war international organizations but created more than 150 new ones. The League of Nations' *Handbook of International Organizations* lists about 400 international organizations of all kinds. The *International Labor Directory,* published by the International Labor Office, classifies international organizations under seven heads, viz., government (League of Nations and International Labor Organization), employers, workers, intellectual workers, ex-service men, cooperatives and miscellaneous.

For convenience, international organizations may be classified as governmental, partly governmental and private. The League of Nations and the International Labor Organization are the only examples of strictly governmental international unions, although the Pan-American Union, the Pan-Pacific Union, and other semi-governmental organizations not only represent governments but exercise some official functions. Partly public unions are represented by those bureaus established by international treaties or otherwise to perform certain public functions, e.g., the International Bureau of the Universal Postal Union. There are between 30 and 40 organizations in this class.

The multitude of private international organizations range over the entire field of human behavior from the International Sunday Observance Federation to the International Commission on Illumination. Only labor and employer unions are treated in this article.

Labor Unions. The so-called First International founded in 1864 by KARL MARX and Friedrich Engels, aimed to unite the workers of the world and to overthrow political and industrial capitalism. It more or less expired in 1876 at Philadelphia after 12 years of vituperative dissension. The Second International is believed to have been founded in 1889 at the Paris Congress. Its aims were vaguer and its solidarity even looser than were the aims and organization of the First International. The World War utterly destroyed the Second International. The organization sometimes called by that name was completely re-

constituted in 1920 and is officially known as the International Federation of Trade Unions with headquarters at Amsterdam. Its aims are still the unification of all workers of all lands for the socialization of production but the views and methods of the original Second International apparently have been moderated. Its membership consists of the national trade unions of 27 countries, with 13,800,567 members (13% women) reported in 1928 out of about 44,000,000 organized workers estimated for the world. The Federation does not include the organized workers of the U.S.S.R., the United States, Mexico and some other less important countries.

The Third or Communist International, formed in 1918 with headquarters at Moscow, is a union more for political than for economic action. Its aim is to destroy capitalism by force and to establish the rule of the proletariat in all countries. It has affiliates in many lands, but the number of its members is not known even in Russia.

Employers' Organizations. The International Chamber of Commerce was established in 1920 with headquarters in Paris. Its object is to influence governments to encourage international understanding and commerce by removing trade restrictions and adopting common industrial codes and regulations. The membership in 1931 included 959 organizations with about 1,500,000 members, representing 46 countries. Voting membership is confined to chambers of commerce, manufacturers' associations or other business organizations. Individual firms may become associate members. The Chamber holds a Congress biennially.

The International Organization of Industrial Employers was founded in Mar. 1920, with headquarters in Brussels by employers who felt that only through organization could their interests be safeguarded before the International Labor Organization. The object is to study the world problems of industry and labor, particularly questions and proposals which come before the International Labor Conference and studied by the International Labor Office. Employer representatives on the governing body of the International Labor Office have thus far been chosen invariably from the members of this organization.

The International Institute of Agriculture was founded in 1905 with headquarters in Rome. Its objects are to gather and publish statistics of agricultural production throughout the world. In 1930, 67 countries, including the United States, were members.

R. M.

INTERNATIONAL YOUNG MEN'S CHRISTIAN ASSOCIATION COLLEGE, an institution at Springfield, Mass., founded in 1884 as part of the educational campaign of the Young Men's Christian Association. The institution is composed of a School of Arts and Sciences, and a School of Physical Education. It had productive funds in 1931 amounting to $1,107,425. There were 21,000 volumes in the library. In 1931-32 there were 538 students and a faculty of 41, headed by Pres. Lawrence L. Doggett.

INTERPOLATION, a method of finding an intermediate term at any position of the interval of a given series. For instance, in the given table of cubes

a	a^3	Δa^3	$\Delta^2 a^3$	$\Delta^3 a^3$	$\Delta^4 a^3$
0	0				
		1			
1	1		6		
		7		6	
2	8		12		0
		19		6	
3	27		18		
		37			
4	64				

the cube of 1.4 can be found by differencing. (*See* CALCULUS OF DIFFERENCES.) The formula

$$a_x = a_0 + x\Delta a_0^3 + \frac{x(x-1)}{1\cdot 2}\Delta^2 a^3 + \frac{x(x-1)(x-2)}{1\cdot 2\cdot 3}\Delta^3 a^3 + \cdots$$

results in

$$a_{1.4} = 1 + (0.4)\cdot 7 + \frac{(0.4)(-0.6)}{1\cdot 2}\cdot 12 + \frac{(0.4)(-0.6)(-1.6)}{1\cdot 2\cdot 3}\cdot 6 = 2.744.$$

The accuracy of the result usually depends on the number of differences utilized in the process of computation. This method is known as direct interpolation. In case the value 2.744 is given, the process of finding the corresponding number in the first column of the table is called inverse interpolation. The process of finding the number corresponding to a number exceeding the last number of the first column of the table is called EXTRAPOLATION.

A. B.

INTERREGNUM, a period during the abeyance or suspension of royal or other constituted authority, when government is carried on by a provisional headship or executive.

INTERSTATE COMMERCE, commerce which originates in one state and terminates in another state; or, more comprehensively, commerce which affects more states than one. Thus transportation which begins in a given state, passes outside of that state, but terminates finally in the state where it originates is interstate commerce. The term would have little meaning in a politically centralized community, but in the United States the fact that the Federal Constitution vests the control of interstate commerce in the Federal Government, while leaving the regulation of intrastate commerce to the states, has often made it necessary to determine first, when described transactions take on and when they lose their interstate character; and, second, whether, or how far the power of state and Federal Governments are mutually exclusive in their respective fields. The answer to such questions often has, indeed, great economic as well as political and legal significance.

It is not possible, in a brief article, to elaborate upon the characteristic features of interstate commerce.

It may be said, however, that the powers of state and Federal Governments in this field are not mutually exclusive. States may, and do, exercise some authority over interstate commerce carried on within their territory. They may regulate when the Federal Government has not acted, and when the facts do not imperatively require the application of a uniform rule. They may not, on the other hand control interstate commerce which the Federal Government either directs or desires to leave free. The Federal power, for its part, may regulate interstate commerce when it desires to do so, and it may even interfere with intrastate commerce if and when this action is necessary for effective domination of the commerce which is interstate.

In spite of the powers reserved to the states, the Federal Government has found its authority over interstate commerce to be a most effective weapon in enforcing economic policies. Thus the national anti-trust legislation, as well as the organization for the Federal control of railroads rest upon the same constitutional grant. To Congressional power over interstate commerce is due the absence of tariffs or other barriers to free trade, transit and communication between the states. The reverse side of the shield is that unrestricted interstate commerce has promoted an unwelcome standardization, and, perhaps, an undue degree of specialization. In some fields, also, the power of the national government has prevented state action, without providing needed Federal machinery to take its place. This is true to-day in the case of the regulation of aviation, motor vehicle transportation and electric power.

There are no comprehensive statistics showing the volume of interstate commerce, because neither commodities nor persons are stopped and counted when they pass state lines. The probability is that it constitutes much less than one-half of the total commerce of the country. Much local commerce, however, follows after and depends upon prior interstate transactions; so that figures setting forth the relative amounts of state and interstate trade might not be significant, even though they were available. The natural trend of economic development may be expected to increase both the amount and the proportion of the trade between the states. S. D.

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INTERSTATE COMMERCE ACT AND COMMISSION. The Interstate Commerce Act of 1887 provided for the regulation of COMMON CARRIERS engaged in the transportation of passengers or property in INTERSTATE COMMERCE, either wholly by railroad or partly by railroad and partly by water. In the latter case it was specified, however, that both railroad and water must be used under a common control management or arrangement for continuous carriage or shipment. The law declared that common carriers should afford reasonable facilities, at reasonable rates, and that they should avoid discrimination. It set up, finally, machinery for enforcement, of which the most important part was a commission of five members, to be appointed by the President of the United States for terms of six years, with salaries of $7,500. The law of 1887 has never been repealed; it has, however, been greatly expanded. The commission now consists of eleven members, instead of five; the term of office is seven, instead of six years; and the salary of a commissioner is now $12,000. The jurisdiction of the commission has been increased to cover pipe line companies, telegraph, telephone and cable companies operating by wire or wireless; express companies, and sleeping car companies. Its powers also have been enlarged, their exact extent varying according to the nature of the regulated facility. For railroads, to which the Commission's attention is mostly directed, these powers include authority to prescribe maximum and minimum rates, to approve or disapprove new issues of securities, to approve or disapprove proposals for consolidation, to prescribe the form of railroad accounts, and to issue or withhold certificates of convenience and necessity for new construction or for the abandonment of existing lines. The Commission has not power to regulate carriers by motor vehicle, airplane or ship, except when water carriers enter into joint arrangements with connecting railroad lines, nor has it jurisdiction over companies engaged in supplying heat, light, power or water. In these last respects it differs, therefore, from many state commissions whose jurisdiction covers the general field of public utilities, instead of being limited to that of transportation and communication.

During the year ending Oct. 31, 1930, the Commission expended $8,124,776.38, of which $2,534,978.57 was in connection with valuation proceedings. It decided 1,244 formal cases, and handled, besides, a large volume of informal complaints, special investigations, accounting and inspection work. The mere enumeration of sums spent and cases decided, however, gives little idea of the real significance of the Commission's work. Prior to 1914 the chief effort of the Commission was to prevent discrimination between persons or between localities. After 1920 it was positively charged with the duty of establishing rates so that carriers may earn a fair return upon the value of their property. Botl. duties are of the greatest economic importance, as is the still older obligation of protecting the public from extortion. It is safe to say that the Interstate Commerce Act is the most elaborate of all Congressional statutes which attempt to regulate industry, and that the Interstate Commerce Commission is the most powerful and also the most successful of the administrative bodies set up in the United States to interpret and to enforce a law.

S. D.

BIBLIOGRAPHY.—H. C. Lust, *Consolidated Digest of Decisions under the Interstate Commerce Act;* S. L. Miller, *Railway Transportation;* F. H. Dixon, *Railroads and Government.*

INTERTYPE, a slug-casting machine identical to the LINOTYPE in all basic principles. A major claim

of the manufacturer is that construction is fully standardized, so that the basic machine may be built or rebuilt into any one of several different models. Another advantage claimed is reduced wear on a wide-toothed matrix.

INTERVAL, in music, the distance between two tones of different PITCH. The interval is named according to the number of steps in the SCALE between and including the notes in question. From C to D includes two degrees, an interval called a second. But if the interval is altered to C-D sharp, it becomes an augmented second. The three degrees in the scale, C to E, are known as a major third and when the E is lowered a half-tone, C-E flat, the interval is then a minor third. There are major, minor, perfect and diminished intervals in music, as well as those chromatically raised by AUGMENTATION. In modern HARMONY intervals beyond the 9th are commonly used.

INTERVENTION, the forcible interference by one state in the affairs of another. The limits of intervention are not fixed, and the extent of it depends on the power and will of the intervening state. The grounds of intervention vary, but they may generally include the grounds of humanity or civilization, legal reasons, or for the sake of maintaining some policy of interest. The policy of the United States has been in the main that of non-intervention, with a number of departures which have, in the opinion of the government, been justified by the circumstances.

INTESTINAL TUBERCULOSIS: Treatment. *See* LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE.

INTESTINES, the part of the alimentary canal between the stomach and the anus, situated entirely in the abdomen, whose function is to receive partly digested food from the stomach, to complete its digestion, to absorb part of it, and to throw out the indigestible residue along with some excreted substances the intestinal cells receive from the circulating blood. (*See also* ALIMENTARY CANAL.)

It consists of two parts: the upper or small intestine, twenty-three feet long, and the lower or large intestine, five and one-half feet long. The great length is needed in large animals to secure a sufficiently extensive surface for digestion and absorption.

The small intestine has three parts—duodenum (eleven inches long), jejunum (nine feet long) and ileum (thirteen feet long). Its diameter is about 1½ inches at the upper end, one inch at the lower. It is all freely movable, except the lower six inches of the duodenum. It is attached to the dorsal wall of the abdomen, by a double fold of the peritoneum called the MESENTERY: this carries the arteries, nerves and lymphatic vessels between the intestine and the posterior abdominal wall. It also carries the veins to the liver.

The large intestine also has three parts—cecum (two and one-half inches long), colon (five feet long), and rectum (five and one-half inches long). Its diameter is three inches at the upper end, one and one-half inches at the lower end of the colon. The lower end of the small intestine projects through the side wall of the large intestine where the cecum joins the colon. The cecum has the VERMIFORM APPENDIX attached to its free end. The colon is in four parts —ascending colon (seven inches long), transverse colon (twenty inches), descending colon (eleven inches) and sigmoid flexure (about seventeen inches—variable). The flexures at the right and left ends of the transverse colon add a few inches to the total length. The cecum and colon are attached to the posterior wall in the middle line by a peritoneal fold continuous with the mesentery, and serving the same purposes. The ascending and descending colons, together with the adjacent part of this fold, are pressed against and adherent to the posterior wall.

The intestine is made up everywhere of two layers: an inner mucous membrane with a muscular casing around it. All but the rectum has also an outer peritoneal coat. The mucous membrane consists of a lining epithelium, made of a single layer of entodermal cells, about 1/1000 inch thick. Between it and the muscle is a considerable space occupied partly by loose connective tissue carrying nerves, vessels, etc., and by the very thin muscularis mucosae, which serves to readjust the epithelium when pulled out of place.

The thin inner tube of epithelium is the main factor in DIGESTION and ABSORPTION; it produces digestive juices in its glands. Small glands to the number of 4 million are formed as simple test tube-like pits and pour their secretion into the interior when food is present in it. About 4 inches beyond the stomach, two huge glands—the pancreas and liver—pour large quantities of digestive juices into the duodenum. Both are formed from the lining of the duodenum and each is connected with it by a stalk constituting the duct of the gland. They open through one common aperture and their position near the upper end of the tube permits their digestive juices to act upon the food as it passes down through the whole length of the small intestine.

Absorption is effected by the non-glandular part of the lining epithelium. The fluid part of the food is taken up by the cells, passed through them and is then given up by them to fluid-filled intercellular spaces which surround their attached ends. From these spaces carbohydrate and protein food is absorbed by blood capillaries, and carried by intestinal veins to the liver. Fatty food is absorbed by lymph capillaries and carried by lymph vessels to the thoracic duct which empties into the veins at the root of the neck. In the liver, which is the great food storehouse, some final changes in the food prepare it for utilization by the body cells, to which it is carried by the circulating blood, as needed.

The absorbing surface is greatly increased in the small intestine by (*a*) circular folds, and (*b*) villi. The circular folds are nearly 900 in number; there are many millions of villi. Both extend throughout the small intestine.

The epithelium of the large intestine has no villi or circular folds: otherwise it resembles that of the small intestine. Lymphoid nodules occur in the mucous membrane of both intestines, being largest in the ileum. Their function is not definitely known, but many bacteria are found in them in typhoid fever, tuberculosis, etc.

The muscular coat propels the food along the intestine. It consists of an inner circular and an outer longitudinal layer of smooth muscle. The former is thickened in certain places to form ring valves, as between intestine and stomach (pylorus), at the lower end of the rectum and at the junction between small and large intestine. The longitudinal layer in the colon is concentrated in three long bands called taeniae. Food takes about four hours to go through the large intestine. The peritoneal coat is smooth and slippery and permits free movement of all parts not adherent, on one another and on the abdominal walls. B. C. H. H.

INTESTINES, INDUSTRIAL USES OF. Besides use as SAUSAGE containers, intestines obtained from livestock as a by-product of meat packing serve numerous industrial and commercial purposes. The gut used as strings for musical instruments and for tennis rackets is prepared from sheep intestines. Cleaned and dried sections of cattle intestines, made into sheets, are used by goldbeaters in the preparation of very thin gold leaf. The gold to be beaten is placed between the intestinal membranes. Other uses are for surgical plasters and for lining pipes to keep fluids from contact with metal.

INTOLERABLE ACTS, the popular American designation of five Acts of Parliament, 1774, designed to crush revolutionary tendencies in the colonies, but which actually hastened the Revolution by their stringent, repressive character. The first of these was the BOSTON PORT BILL, intended to punish the city of Boston for the BOSTON TEA PARTY. The second, the Massachusetts Government Act, practically annulled the charter of Massachusetts, withdrawing prerogatives from the elective Assembly and bestowing them upon the governor and the Crown. The third, commonly called the Transportation Act, provided that royal officials accused of capital offenses, including soldiers who might be accused of murder in suppressing riots, be removed for trial to some other colony or to Great Britain at the discretion of the governor. The fourth, the Quartering Act, made it obligatory upon Massachusetts towns to furnish barracks and other aid to British troops. The fifth of the Intolerable Acts was the QUEBEC ACT, providing for the government of Canada and the Northwest. These five acts were carried through Parliament by overwhelming majorities, and encountered equally overwhelming resentment in the colonies. There was, in fact, no ulterior motive in the attachment of the Ohio valley to Canada, but the Colonies viewed it as a flagrant alienation of their rightful domain.

INTUITION, a form of immediate knowledge; that which is immediately perceived. Intuition is contrasted with mediate inference. The term is used to cover immediate judgments in several fields, such as intuitions of sense, intuitions of reason and intuitions in morals. Present an object to sense, such as a table, and its meaning as table may be intuitively grasped.

An intuition of reason is one that when presented to the mind appears self-evident. Intuitionism has found a stronghold in the field of morals, where certain moral conceptions are said to be immediately perceived either as right or wrong. The theory is probably best represented by the moral sense school, but intuitionism in ethics may take a number of different forms.

The term intuition as a scientific concept had fallen somewhat into disrepute until HENRI BERGSON revived it and made it one of the keystones in his philosophical position. He holds that the intellect has a tendency to distort knowledge, and that in order to reach the truth it is necessary to use intuition. By intuition here he means a more instinctive approach, an attempt to penetrate to the inside of things, as it were. For example, the intellect divides time into instants, whereas intuition sees time as a flow. This conception is necessarily somewhat mystical.

INUKAI, TSUYOSHI (1855-1932), Japanese Premier, was born at Okayama. He entered political life early and served as a member of the Japanese Diet since its inauguration in 1890. Beginning in 1898, he held various cabinet posts, and, after organizing and leading various smaller political parties, he became the president of the Seiyukai in 1929. As head of the principal opposition party in the diet, he became Premier upon the fall of the Hamaguchi cabinet in Dec., 1931. Premier Inukai was assassinated May 15, 1932, by a small group of Japanese army and navy officers.

INULIN, an organic chemical substance belonging to the CARBOHYDRATES, with properties similar to those of starch and gum, and having as its general formula a multiple of $C_6H_{10}O_5$. It is found in many plants such as the dahlia and the dandelion, in bulbs and in the ordinary potato; when pure, it is a white powder, easily soluble in warm water.

INVALID FOODS are for dietary therapy or to supply special needs in nutrition. The following are important invalid foods.

Modified-milk products (*see* MILK) are for infant feeding.

Protein foods (*see* PROTEIN IN FOODS) are used to increase the protein content of liquid foods. They are sometimes predigested to avoid irritation of the intestines or for rectal alimentation, and are usually dry powders made from meat, casein, legumes, or wheat gluten.

Prepared carbohydrate foods are for the nutrition of infants and for modifying bacterial action in the intestinal tract. Most are prepared from starchy foods, but glucose and lactose (milk sugar) are also used.

Non-nutritive foods are for the treatment of obesity, diabetes, and other conditions in which limited amounts of foods, especially of carbohydrates, are

indicated. They are often obtained from cellulose products, and palm nuts.

Vitamin foods (*see* VITAMINS IN FOOD) are rich in one or more vitamins and used in the so-called deficiency diseases (scurvy, rickets, beri-beri, pellagra, xerophthalmia, etc.). COD LIVER OIL or its derivatives is the commonest.

Diabetic foods are characterized by low digestible carbohydrate content. *See also* FOOD; VITAMIN DEFICIENCY DESEASES. C. L. A.

INVALIDITY PENSIONS. *See* INSURANCE.

INVAR, a nickel steel, containing 36% nickel, having a very small coefficient of expansion. It is used in various measuring instruments. *See* NICKEL STEEL.

INVARIABLE PLANE of the solar system, the name given to that plane which, regardless of the motions of the various PLANETS, always keeps its same position and orientation in space.

INVENTION, the term employed, roughly speaking, to describe that human activity which results in the production of some contrivance which will make new things, perform labor in a new and more efficient way, and in general, will lessen the burden of mankind in its economic and cultural tasks. As such, the term invention stands opposed to discovery, by which is generally meant the detection of things or relations already existing in nature, but this distinction is probably no longer sharp enough to be entirely justifiable; moreover, an invention nearly always implies a certain amount of discovery.

Any really important invention is rarely the product of any one person—it is not so much a creation as a growth from previously known things, while furthermore it appears that, with a few outstanding exceptions, inventors are not born, but made. That is to say, hereditary influence and qualities are, generally speaking, of less importance than education and economic environment. This view is borne out by the observation that while real inventive genius—which is of the born type—is probably rare, invention is reasonably common. In this same connection may be mentioned the fact that while some inventions undoubtedly are accidental, many are made to order, i.e., when the times are ripe for a certain type of invention to be made, then it may be expected to be made, and often simultaneously and independently by more than one inventor. Since the introduction of methods of scientific research into industry, inventions have become very largely a matter of organized endeavor, they are deliberately searched for, and their achievement is attained by successive, carefully planned and executed steps.

The general level of culture and the distribution of mental ability over the population are without doubt important factors contributing to the frequency and success of inventions, but it has also been argued that inventions are largely caused by pecuniary motives, or are the inevitable concomitant of a régime of economic competition, while the Marxistic doctrine (*see* KARL MARX) even goes so far as to attribute the stimulus for invention to capitalistic desire to increase the surplus profit of manufacturing.

Some of the prehistoric inventions might perhaps be more appropriately classed as discoveries, such as that of the control of the growth of plants from seeds —probably the most fundamental discovery ever made in our civilization—while others such as the making of pottery and the establishing of a system of handwriting more nearly fall in the category of real inventions. It would be difficult to say which are the few all-important inventions of modern times, but without question such a list would have to include that of the art of printing, the steam engine, the development of electricity as a source of power, heat and light, the internal combustion engine, the making of cement and of working metals, especially iron and steel.

INVENTION, PSYCHOLOGY OF, the art of putting things together in a new way. Psychologically, invention is the opposite of imitation. Imitation stands for the customary, invention for the new. Because patents are given for inventions, the notion is common that an inventor produces something absolutely new and is not indebted to society for his invention, that, rather, society is indebted to him. Invention, however, is a social process. The inventor is both a part and a product of society. He gets his cues and patterns from society and sees the need of his invention in the society about him. True enough, he makes a contribution, but this contribution is new only in the sense that any contribution is new; it is merely relatively, not absolutely so. Invention represents the initiating, the modifying and the reconstructing forces at work in society. As such, it is opposed to the inertia of custom and the fixity of institutions. Inventions do not spring out of the clear sky; they are a social growth, a product of social evolution.

INVENTORY, a term usually applied to an itemized list of stock-in-trade, which may also include operating supplies Inventories are either book or physical. When a stock book is kept wherein receipts and issues—i.e., sales or requisitions—are recorded on the same value basis, the difference between them should represent the value of stocks remaining on hand. Variations occur because of lost or stolen goods and under-or-over-measures when goods are sold. A physical inventory consists of an actual count and measurement of all stocks on hand and their proper valuation—the unit value multiplied by the number of units. Cost or replacement cost is the usual value basis.

INVERCARGILL, a town of South Island, New Zealand, principal city of Southland County and situated on New River Harbor, about 140 mi. by rail southwest of Dunedin. Lying in a rich agricultural region, it is the center of several important industries utilizing the products of the district. Chief among these industries are brewing, flour-milling, wool-manufacturing, meat-packing and lumber. Pop. 1931, 20,400.

INVERNESS, county town, royal burgh, and seaport of Inverness-shire, Scotland, lying about 115 mi.

northwest of Edinburgh, on the Ness. The present castle, built about 1835, replaces the fort destroyed in 1746 by Jacobites, traditionally founded by Malcolm Canmore after demolishing an even earlier one in which Macbeth slew Duncan. In the parish church are bells taken by Cromwell from Fortrose Cathedral, and across the river is St. Andrew's Cathedral. Modern Inverness is a city of fine public buildings and parks, and as "capital of the Highlands" it is an important tourist and railway center. The river mouth facilities afford it a large shipping trade. Inverness has ship-yards, breweries and distilleries and is a market for wool and sheep. Pop. 1921, 20,944; 1931, 22,582.

INVERSION, name given in organic chemistry to the process taking place during the fermentation and hydrolysis of such substances as sugar. It derives its name from the fact that, whereas before the reaction took place the plane of polarization of light was turned toward the right by the sugar solution, it is turned toward the left after inversion has been completed. Ordinary SUGAR, or SUCROSE, is a disaccharose of formula $C_{12}H_{22}O_{11}$; upon taking up one molecule of water, H_2O, its molecules split into one molecule each of glucose and fructose, both monosaccharoses, and both having the formula $C_6H_{12}O_6$, though differing in internal structure. GLUCOSE, or DEXTROSE, turns the plane of polarization toward the right, but FRUCTOSE or levulose turns it toward the left by a greater amount. If cane sugar (*see* SUGAR, CANE) is simply dissolved in water, inversion takes place at a very slow rate; but this speed is considerably accelerated by the presence of dilute acids, which thus act as catalysts, or by the addition of an enzyme (called *invertase* for this reason), which is found in some fungi. Other carbohydrates, such as STARCH, DEXTRIN, LACTOSE, and MALTOSE, are likewise subject to inversion, glucose always being one of the products formed. Continued fermentation of glucose by yeast gives rise to alcohol.

INVESTIGATION, BUREAU OF. *See* JUSTICE, DEPARTMENT OF.

INVESTITURE, a ceremony whereby a person is placed in occupancy of an office or, as in Roman law in the possession of property. In government it has been particularly applied to the investing of bishops and abbots with their sees and monasteries by royal action.

INVESTMENT, in a concrete sense, consists of the productive employment of capital. The requisites are commitment of capital for use in production; capital entrusted to the management of another; the primary purpose is to derive income rather than principal appreciation; the premium for the risk must not exceed the true interest.

Common usage embraces a more liberal definition of investment to include preferred and common stocks with bonds, although the owner may have a voice in the management and despite the fact that there is no agreement to return the principal nor to pay for its use. This point of view is the outgrowth of a variety of factors; among which may be listed industrial expansion in the United States, the improvement in the banking system and credit structure which has contributed to the decline in the purchasing power of money, wider distribution of wealth, opportunities for greater diversification, higher grade issues, owing to the efforts of state legislatures in enacting Blue Sky and similar laws designed to prevent the sale of fraudulent securities, the influence of Better Business bureaus and the rigid requirements of the reputable stock exchanges, and the greater variety of offerings at modest prices by reliable investment bankers.

There are certain desirable elements in every investment. It is quite impossible to obtain all of them to the extent desired in a single issue. They are security of principal, stability of income, fair income return, marketability, taxability, collateral value and potential appreciation.

The earning power of a corporation is the best test of its ability over a period of years to pay interest and principal. A period comprising all phases of the business cycle is the minimum length of time that can be considered an adequate test.

Next in importance to earnings are the amount and nature of property pledged as security. Specialized assets are of dubious value in the event of forced liquidation. The value of unsecured bonds depends on the nature of the business and the efficiency and integrity of management, as reflected in the sustained earning power of the obligor over a period of years.

The income should be paid regularly, but this desideratum does not always follow despite the security of principal. The principal of real estate mortgage bonds is at times much safer than the intervening interest obligations. Returns on bonds, especially government obligations, and on annuity insurance are paid with the greater regularity.

The rate of return should be governed by the current interest rate and the premium for the risk assumed. Although the true rate varies, it always exists, and should be considered lest the assumption of risk be excessive. Despite the fact that an investor makes more or less permanent commitments, the need for readily converting the security into cash without sacrifice may arise at any time. Therefore, a fair degree of marketability is desirable. Marketability means lessened income return, and should not be unduly stressed. The small investor is not concerned with tax-exempt securities, but the large investor who neglects this important feature will realize a smaller return than is necessary. Federal and state normal tax, surtax, inheritance and estate taxes eat heavily into income and principal.

Closely akin to marketability is the collateral value of a security. Bankers readily accept as collateral for loans, highly marketable issues even though they may not be of high investment rank. Real estate mortgages are of little use in such instances.

Increase in the market value of a security may not be predicted with assurance, otherwise the element of

appreciation would be reflected in the purchase price. Nevertheless, the market value of investments do appreciate, owing to several causes. The shrewd investor duly regards such possibilities when selecting his securities. T. C. J.

INVESTMENT BANKER, a middleman who buys securities from those who need long term or fixed CAPITAL and sells them to investors. He performs the following functions: brings together the accumulated funds of savers and makes them available in large quantities for the purpose of production; selects the enterprise or enterprises which he will assist in financing, and, in this way, exercises a tremendous influence upon the distribution of funds among the various classes of business units which want additional capital; cooperates frequently with the organizers of a business in working out their financial plans. He takes an active part in determining the class of security that will be issued and the time when it will be offered to the public. The investment banker frequently finds that he must supervise to a certain extent the business which he is financing. His work also involves the analysis of the affairs of the corporation before accepting the issue. It is usually necessary to organize an underwriting syndicate of which he becomes the manager, to assist in the distribution of the securities. J. M. C.

INVESTMENT TRUST, an organization to which a large number of investors contribute funds jointly to be invested in a well selected and diversified list of securities with the object of securing a larger income through able management than could be done individually. Contributions are usually made through the purchase of the STOCK or BONDS issued directly by the trust which, in turn, invests in the securities issued by other concerns. The investment trust in its proper form is an investor and does not seek to control or manage the corporations whose securities have been purchased.

The investment trust as it is known today had its origin in Great Britain after 1860 though writers frequently refer to the existence of an organization in Brussels in 1822. This type of financial institution enjoyed its greatest development in England and Scotland. Progress was slow at first but a rapid expansion took place shortly before the crisis of the early nineties. The investment trust movement is comparatively new in the United States. Disregarding the semi-investment companies organized before and during the World War, the development started in this country after 1920. Investment trusts were not popular at first but a rapid expansion took place during the two or three years prior to the stock market crash in 1929.

Investment trusts are frequently confused with other types of financial institutions such as trading corporations, HOLDING COMPANIES, mortgage companies, foreign trade corporations, financing companies and collateral loan companies. The principal function of each of these organizations is not that of investing a fund to secure a larger return.

There are different types in the United States. There is, first, an unincorporated organization from which the investors enjoy an income in proportion to the amount contributed after deducting a small fee for management. There are three varieties of the corporate form, the management type, the fixed type and the semi-fixed type, according to method of handling the portfolio. Officers and directors of the managed type are free, within limits prescribed by the charter and by-laws, to invest the funds as they think best. In the fixed type the funds must be invested in a given list of securities throughout the life of the trust. Securities owned are usually left with a BANK or TRUST COMPANY under a trust agreement or an indenture. The semifixed type is quite similar to the fixed with the exception that the management may make a limited number of substitutions in the portfolio from time to time. There are several modifications of these three types in actual existence. J. M. C.

INVISIBLE EXPORTS. *See* EXPORTS, INVISIBLE.

INVISIBLE LIGHT. *See* EMISSION SPECTRUM.

INVOICE, a written document sent with a shipment giving the quantity and price of goods shipped to a customer, consignee or factor, together with a statement of the charges on such goods. Countries which impose AD VALOREM duties usually demand a consular invoice of goods imported, which is a document signed by a consul of the country of import.

INVOLUTION. A term formerly used in most arithmetics to denote that branch dealing with powers. For example, $3^2 = 3 \times 3 = 9$, so that 9 is the second power of 3. It is still used in algebra for the same purpose, and occasionally in arithmetic. For example, the third power of $a + b$ is $a^3 + 3a^2b + 3ab^2 + b^3$. *See* ROOT; EVOLUTION; BINOMIAL THEOREM.

IO, in Greek mythology, daughter of Inachus, the river god and first king of Argos. Hera was jealous of ZEUS' love for Io and so Zeus changed Io into a white heifer. The goddess set Argus to watch Io, but Zeus had him killed by HERMES. Hera next sent a gadfly to torment the heifer, who wandered over the earth to escape its sting. Finally reaching Egypt, Io regained her original form and gave birth to Epaphus. Another version of the legend makes her transformation the work of Hera. Under the name of Callithyia, Io was priestess of Hera.

IODIDES, chemical compounds containing iodine and another element or radical, the other element or radical being necessarily more electropositive than the iodine. Iodine, possessing strong powers of combination, unites with the pure metals and with most of the simple non-metallic substances. *See also* IODINE.

IODINE, a non-metallic chemical element of the halogen group (symbol I, at. wt. 126.93). It is a black solid substance with a crystalline structure rhombic in form and a characteristic penetrating smell less pungent than that of BROMINE or CHLORINE. Iodine was formerly obtained entirely from seaweed, but now the greater part of the supply comes from sodium iodate ($NaIO_8$), comprising about 2% of

crude Chile saltpeter. It is separated from the sodium iodate by displacement by chlorine or by being mixed with manganese dioxide and heated with sulphuric acid. It melts at 114° C., boils at 184° C. and has a vapor of a rich violet color. It is slightly soluble in water, but is soluble in chloroform, alcohol and aqueous solutions of iodides. It is a non-conductor of electricity; and possesses strong powers of combination, uniting with most of the metals and many non-metallic substances to form iodides, with hydrogen and oxygen to form iodic acid, with hydrogen alone to form hydriodic acid.

In medicine, an alcoholic solution of iodine and potassium iodide (tincture of iodine) is widely used as a germicide for abrasions and preliminary to operations. Internally, iodine is irritating to the mucous membranes and is administered, therefore, more generally in the form of iodides, as an alterative and in the treatment of syphilis. Small amounts of iodide are extremely useful for prevention of GOITER. *See also* CRETINISM. P. N. L.

IODINE-BUSH, a name sometimes given to the BURRO WEED, a small, leafless, green-branched shrub found in southwestern deserts.

IODOFORM, a yellow crystalline substance (CHI_3) with a penetrating odor and an unpleasant iodine-like taste. It melts at 119° C., and is slightly soluble in water, but soluble in alcohol and ether. It is produced by the action of iodine and aqueous potassium hydroxide on ethyl alcohol, acetone, etc. Iodoform is employed generally as a mild analgesic, an antiseptic and disinfectant. It is used as a dusting powder for open wounds; when swallowed it may produce poisonous symptoms.

IOLA, a city in southeastern Kansas, county seat of Allen Co., situated on the Neosho River, 110 mi. southwest of Kansas City. Bus lines, airplanes and three railroads afford transportation. Iola is a shipping center for legumes and dairy products. The city is located in a rich oil and gas district. Oil tanks and clothing are its chief manufactures. Iola was founded in 1858 and incorporated in 1865. Gen. Frederick Funston once lived here. Pop. 1920, 8,513; 1930, 7,160.

IOLITE, a rock-forming silicate, usually translucent to transparent and light to dark, smoky blue, but sometimes gray or yellow. It commonly occurs in masses or grains resembling blue quartz, but also as orthorhombic crystals, in granites, gneisses and some schists. It is dichroic, being yellowish by transmitted light in one direction, and blue at right angles thereto, whence another name, DICHROITE. It is called also cordierite. Iolite is a hydrous silicate of magnesium, iron and aluminium. A transparent gem variety from Ceylon is called water sapphire. Ordinary iolite is of fairly common occurrence. *See also* ORTHORHOMBIC SYSTEM; GEM STONES; PLEOCHROISM.

IO MOTH, a medium-sized species (*Automaris io*) of the family of giant silk-worms (*Saturnidæ*). Adult females have purplish or red fore wings. Adult males are smaller, their fore wings canary yellow in color. Hind wings of both sexes have large eye-spots on a yellow background. Mature larvæ are green with a broad reddish strip on each side, margined below with white. They are armed with tufts of venomous spines. Food plants include wild cherry, corn, cotton, hops, clover and elm. Cocoons are of brown silk, often enclosed or protected by a leaf.

ION, one of two electrically charged ATOMS or groups of atoms into which a MOLECULE of a substance is separated by ELECTROLYSIS. When a salt or an acid is dissolved in water, its molecules dissociate into positively and negatively charged ions, each of which may consist of one or more atoms. If the terminals of a BATTERY are connected to two metal electrodes immersed in the solution, an electric current will pass between them as a result of the motion of the two sets of ions.

Ions may be produced in gases by the various methods described under IONIZATION. ELECTRONS are removed from neutral gas molecules, leaving them positively charged, i.e., positive ions are formed. The free electrons attach themselves quickly to other molecules, forming negative ions. Frequently, several such molecules combine, but the particle is still called an ion. The presence of these ions may be detected by observing the flow of electricity through the gas when a battery is used. The velocity of "old" ions in dry air under a potential gradient of one VOLT per cm. is 1.6 cm. per sec. for the positive ions and 2.2 for the negative. If positive and negative ions are left together, they recombine in a few seconds to form neutral particles, because they normally move about and collide. *See also* IONIC THEORY; IONIZATION. J. B. H.

IONA, an island of Scotland in the Hebrides group. It comprises an area of about 3 sq. mi. and is 3½ mi. long and 1½ mi. wide. Grains and potatoes are the principal crops produced on the small portion that is cultivated. Some of the inhabitants are engaged in fishing. A celebrated abbey was founded here in the 6th century by St. Columba. There is also a cathedral dating from the 13th century. The inhabitants number fewer than 250.

IONIA, a city in southwestern central Michigan, county seat of Ionia Co., situated on the Grand River, 40 mi. east of Grand Rapids. Bus lines and two railroads serve the city. Ionia is located in a good farming region. The chief manufactures are furniture, pottery, porcelain tiles and automobile bodies. It is the seat of the State Reformatory and the Hospital for the Insane. Ionia was founded in 1833 and incorporated in 1873. Pop. 1920, 6,935; 1930, 6,562.

IONIAN ISLANDS, an insular group in the Ionian Sea, belonging to Greece and lying west of the mainland, consisting of Corfu, Cephalonia, Zante, Santa Maura, Paxo, Ithaca, Cerigo and lesser islands, with a combined area of 905 sq. mi. The group, generally mountainous in surface, extend in a roughly northwest to southwest direction, with Corfu in the north, Cephalonia, which has an extreme altitude of more than 5,000 ft., in the middle, and Zante in the

south. On the fertile plains of a few of the larger islands the natives cultivate currants, grapes, olives and fruits, but the scarcity of rainfall restricts extensive agriculture. Fishing engages a large percentage of the inhabitants. The chief towns of the Ionian Islands are Corfu, Zante and Vathi (Ithaca). Venice obtained control of the group about 1400. The islands were seized by France in 1797, by the Turks and Russians in 1799, and in 1800-07 enjoyed independence as the Seven United Islands. In 1815 they had protectorate status under Great Britain but in 1864 were annexed to Greece.

IONIAN SCHOOL, the group responsible for the first speculations of the early Greeks. Because all of the Greek thinkers of the pre-Socratic period were Ionians, in the broader sense of the word it is proper to designate them all as belonging to the Ionian School. In the narrower sense the first group has been designated as the Ionic School. This includes THALES, ANAXIMANDER and ANAXIMENES, all belonging to the 6th century B.C. The main purpose of these Ionians was to find the underlying substance of things. For Thales it was water, for Anaximander the unlimited and for Anaximenes it was air. Using the term the Ionian School to cover the entire period up to the time of Socrates, other schools, such as the Eleatics, the Heraclitics, the Pythagoreans and the Atomists, would be included. Throughout the period the main problem studied was that of the relation between permanence and change, the one and the many. The interest was primarily in nature as contrasted with later Greek speculations.

IONIC ORDER, the second of the Greek, and the third of the Roman and Renaissance orders. For a complete description, *see* ORDER.

IONIC THEORY, the name given to the theory, in chemistry, proposed by Arrhenius in 1887, which supposes that salts, acids and bases, when dissolved in water and similar liquids, dissociate into electrically charged particles called ions; such substances being, therefore, called electrolytes. Thus, a molecule of sodium chloride (NaCl) dissociates into a sodium ion, charged positively, and a chlorine ion, charged negatively: $NaCl = Na^+ + Cl^-$. In their chemical properties, these ions are entirely different from the corresponding uncharged atoms, as, e.g., the sodium ion can coexist with water while the sodium atom reacts violently with it; the chlorine ion is colorless and odorless, the chlorine atom greenish, and of a pungent smell. This theory of electrolytic dissociation was originally proposed to explain the extraordinary behavior of such solutions which did not follow the theoretical laws concerning their osmotic pressure, the elevation of the boiling point, and the lowering of the freezing point of the solvent, but which showed effect much larger than were calculated from the number of molecules present. The explanation now appears simple, as these changes in the physico-chemical constants of the solvent are proportional to the number of particles present per unit volume of the solution, and hence, if a dissolved substance, such as NaCl, becomes partly ionized, the number of particles is greatly increased.

A solution of an electrolyte, then, should become a conductor of the electric current and from the amount of conductivity it is then possible to calculate the amount of dissociation, independently of the value derived from the lowering of the freezing point. Concordance between the two methods furnishes proof for the theory.

The presence of ions with almost complete freedom of motion, furthermore, explains the nearly instantaneous completion of reactions between electrolytes, while those between undissociated organic substances proceed only slowly. The existence of electrically charged ions has since been substantiated by the researches of Bragg on crystal structure.

Different substances show a different degree of dissociation, "strong electrolytes," such as hydrochloric acid, nitric acid, and the hydroxides, chlorides, nitrates, and sulphates of the alkalis, ionizing to a very large extent, while the weaker acids, bases and their salts do so only in a moderate degree. Originally it was supposed that, even for strong electrolytes, complete dissociation was not reached until the dilution became very great; it now appears, however, that these are practically always completely ionized, but that the mobility of the ions is less in a concentrated solution, thus giving the appearance of incomplete dissociation, while, moreover, the electric forces are now thought to play a more prominent rôle. The weaker electrolytes are only partly ionized, and there is always an equilibrium which is to be maintained between the amounts of ionized and un-ionized substance, materially influenced, for the very weak electrolytes, by the dissociation of water itself into hydrogen and hydroxyl ions. *See also* CHEMICAL EQUILIBRIUM; CONDUCTIVITY (of solutions); ELECTROCHEMISTRY; ELECTROLYSIS; HYDROGEN-ION CONCENTRATION; HYDROLYSIS; SOLUTIONS. W. J. L.

IONIUM, an elementary substance belonging to the radioactive series of uranium and radium, having the atomic weight 230 and forming an isotope of thorium. Its time period is about 80,000 years, during the course of which time half of it is transformed into radium. *See* RADIOACTIVITY.

IONIZATION, the process of removing or of adding ELECTRONS to neutral ATOMS or MOLECULES. The charged particles which result are called IONS, and these may be detected by the electric current which flows when they move in an electric field. The ionization currents are usually small (10^{-6} to 10^{-14} ampere) unless cumulative ionization sets in, as in electric sparks and arcs, when they may become very large.

By bombarding various gases in evacuated glass bulbs by electrons of known energy, the work needed to remove electrons from the various "shells" in the gas atoms can be determined. Thus, the internal structure of the atom can be studied. The energies involved are spoken of as ionizing potentials.

When X-RAYS, GAMMA RAYS, ultra-violet LIGHT

rays, ALPHA PARTICLES or BETA RAYS pass through a gas, its molecules are ionized. The gases in a flame are ionized by the heat. Positive rays and high-speed electrons also serve to knock electrons out of neutral atoms and molecules. One alpha particle will produce approximately 100,000 ions for every cm. it traverses in a gas at normal pressure and temperature. Ionization by X-rays is largely an indirect process whereby the X-rays knock out a few electrons, each of which ionizes a large number of neutral gas particles.

A solution of salt and water is a conductor of electricity, because ions of SODIUM and CHLORINE, the constituents of ordinary salt, are formed. These ions are charged oppositely, so that they move in opposite directions to constitute the current of electricity. *See also* ELECTROLYSIS. J. B. H.

I.O.U., a written acknowledgment of a debt. On its face it bears the letters I.O.U., the amount of the debt, the date and the signature of the debtor; the name of the creditor is sometimes included but is not essential. An I.O.U. is not a promissory note (*see* BILL OF EXCHANGE) as there is no agreement to pay, and it is not negotiable.

IOWA, a North American Indian group speaking the Chiwere dialect of the Siouan linguistic stock. The Oto and Missouri belong to the same dialectic group. With these, the Omaha and Ponca, the Iowa are believed to have branched off from the Winnebago. Early in the 19th century they were living south of the Platte River in southeastern Nebraska. From this time they remained here chiefly as fur traders and agriculturists until they were placed under reservation control. Culturally they were intermediate between the Woodland and Plains Indians. They lived in oval bark or mat-covered houses or in tipis. Their costume was like that of the other Eastern Woodlands tribes. Their ceremonials also partook of both cultures, since they had both the military societies of the Plains and the medicine society of the Woodlands, as well as sacred clan bundles.

IOWA, one of the west north central group of states of the United States, popularly called the "Hawkeye State." It is situated between 40° 36′ and 43° 30′ N. lat. and 89° 5′ and 96° 31′ W. long. On the north Iowa is bounded by Minnesota, on the east by Wisconsin and Illinois with the Mississippi River forming the boundary on the south by Missouri and on the west by Nebraska and South Dakota from which it is separated by the Missouri and Big Sioux rivers respectively. Iowa comprises an area of 56,147 sq. mi., inclusive of 561 sq. mi. of water surface, with a maximum length of 310 mi. from east to west and of 205 mi. from north to south. In size Iowa ranks twenty-fourth among the states of the Union.



IOWA STATE SEAL

Surface Features. The topography of Iowa is a level surface with rolling hills. Between its maximum altitude above sea level, 1,675 ft., in Osceola County on the northern border, and its lowest point, 477 ft., at Keokuk, there is a relief of 1,198 ft. Its mean elevation is 1,100 ft. In the northern part there are a few small lakes including Storm Lake, Spirit Lake and Okoboji.

Two drainage basins are formed by a water parting extending south from the northern boundary of the state. The small streams of the western part are tributary to the Missouri River. The eastern area comprising the larger part of the state is drained by the Des Moines and Iowa rivers into the Mississippi. Nearly all the streams flow between steep if not vertical cliffs overlooked by distant hills. Along the Missouri are sheer grassy banks rising steeply from the water.

Climate. With its great variations between summer and winter, the climate of Iowa is a good example of the continental type characteristic of the northern Mississippi Valley. The mean annual temperature for the state is 48° F. At Des Moines the average for January is 20.1° F. and for July, 75.4° F. During the period, 1873-1930, the highest temperature recorded in Iowa was 113° F. and the lowest, —47° F. The average annual precipitation is 32.2 in. including 30.7 in. of snow, more than two-thirds of which usually falls during the crop-growing months. April 21 is the average date for the last killing frost in spring and October 10 that of the first killing frost in autumn, giving an average growing season of 172 days. The high average temperature, humidity and rainfall during midsummer, together with the uniform fertility of soil, make Iowa the most highly productive state in the CORN BELT.

Forests and Parks. The scattered forests of this agricultural state which originally covered less than one-seventh of its land area and were located chiefly along the banks of streams and shores of lakes have been very largely cut down. The principal native trees are white pine, hemlock, oak, maple, elm, walnut, cottonwood and basswood. Iowa has an extensive system of 39 state parks containing natural caves, narrow limestone gorges with rare flowers and ferns, old Indian mounds, limestone cliffs on Cedar River and loess formations in the Missouri Valley. Many have various types of prairie and glacial lakes (*see* CLEAR LAKE) including meander lakes of the oxbow type along the Mississippi and Missouri rivers in which the American lotus is found.

Minerals and Mining. The state's most valuable mineral resources are its bituminous coal fields embracing about 13,000 sq. mi., in the central and southern counties; important gypsum beds in the vicinity of Fort Dodge, and inexhaustible deposits of clay and limestone for making cement and other products. With mineral productions in 1929 amounting to $35,954,895 Iowa stood twenty-eighth among the states, ranking second in gypsum and eleventh in coal. The leading products were coal, 4,241,069 tons valued

at $11,948,000; cement, 6,586,111 bbls., $9,781,159; clay products, $5,770,125; gypsum, 718,503 tons, $4,668,856; sand and gravel, $2,240,638, and limestone, $2,165,957. During 1929 247 mines and quarries gave employment to 7,812 persons who received $10,430,568 in salaries and wages.

Soil. No state in the Union equals Iowa in the proportion of arable land to its total area, and, regarded as a whole, no state possesses a more fertile soil for general agriculture. Three distinct types of soil are extensively found: 1. Alluvial soil, 2. Glacial drift soil, and, 3. Loess soil. Alluvial soils, comprising some of the most highly fertile lands in the state, are found in the river bottoms, as, for example, the Missouri bottoms which extend for more than 100 mi. with a breadth of some 10 mi. in places. The various tracts of alluvial soil comprise about 1/16 of the total area of the state. Next in fertility are the glacial drift soils which consist of clay, sand and gravel, with abundant lime. These rich soils, which in some areas exceed alluvium in fertility, cover two-thirds of the surface of the state and are predominant in the north and northwest. Throughout large areas the glacial drift soils are overlaid by a black loam, rich in humus and a foot or more thick. The loess soils, a distinctive loamy deposit composed chiefly of porous clay and lime carbonate, form the high nearly vertical bluffs overlooking the alluvial bottoms of the Missouri River and are widely distributed elsewhere in the state, especially in the northeast. In fertility the loess soils, which cover fully one-fourth of the entire area of Iowa, are equal to most of the glacial drift soils.

Agriculture. Iowa is preeminently agricultural, with a larger proportion of its area in crop land than any other state. In value of crops produced it is surpassed only by Texas and California.

In 1930 34,019,332 ac. or 95.6% of the entire land area was in farms, 214,928 in number, with an average size per farm of 158.3 ac. and an average value per acre of $124.18. Of the farm area 22,738,377 ac. or 67% was crop land; 9,508,644 ac. or 28%, pasture land; and 244,370 ac. or about 1%, woodland. The total value of farm property was $4,992,484,976, of which $4,224,506,083 was represented by lands and buildings; $270,516,267, by implements and machinery; and $497,462,626, by domestic animals.

According to the census of 1930 Iowa produced in 1929 field crops to the value of $466,391,416, ranking third among the states. It stood first in corn and oats, third in hay, sixth in barley, seventh in grapes and eighth in plums and prunes. Grain, valued at $374,912,016, was the leading crop. Of 11,047,539 ac. devoted to corn, 9,683,592 ac. harvested for grain produced 389,000,414 bu., and 248,075 ac. cut for silage yielded 2,108,063 tons. The acreage and yield of other important grain crops were oats, 5,836,126 ac., 208,070,091 bu.; barley, 601,441 ac., 17,417,137 bu., and wheat, 421,189 ac., 7,990,286 bu. Of the hay crop of 5,384,422 tons valued at $64,833,912, timothy and clover contributed 3,840,310 tons or 71%, the remainder being largely alfalfa.

The vegetables, valued at $20,995,347, included potatoes $9,262,973, sweet corn $924,648, onions $617,023, and tomatoes $428,765. Among the fruits, valued at $4,646,091, were apples, 1,539,199 bu.; plums and prunes, 147,255 bu.; strawberries, 5,404,524 qts., and raspberries, 1,310,664 qts.

Farm products sold by cooperative marketing rose from $59,403,626 in 1919 to $74,635,414 in 1929 and farm supplies purchased by this method from $6,760,952 to $7,462,349. During the decade 1920-30 there was a marked increase in the use of modern machinery and other facilities. Automobiles on farms rose from 177,558 in 1920 to 240,512 in 1930; motor trucks from 8,910 to 32,669, and tractors from 20,270 to 66,258.

Animal Industry. Cattle-raising, both for milk and beef production, hog-raising and poultry growing are preeminent livestock interests. According to the census of 1930 the rank of Iowa among the states was first in horses and swine, second in cattle and third in milk cows; it stood first in poultry raised and chicken eggs produced, fourth in milk produced and sixth in dairy products sold. The state ranked first in total value, $497,462,626, of domestic animals on farms. Among these were 4,136,156 cattle reported from 202,827 farms or 94% of all the farms in the state and valued at $236,689,013; swine, 10,055,591 in number valued at $132,190,361; horses, 1,047,527, $82,804,856; mules, 84,960, $7,505,990; and sheep, 1,557,517, $11,904,659.

Of the cows on farms 1,486,496 were kept mainly for milk production and 460,719 mainly for beef production. In 1929, 647,224,237 gals. of milk were produced; the total value of dairy products marketed was $81,596,626, including $65,856,789 for cream sold as butterfat. The value of all poultry raised was $42,053,274. The number and value of the chief kinds were chickens, 48,216,339, $40,251,568; ducks, 898,825, $800,375; geese, 386,564, $637,879, and turkeys, 111,981, $363,452. The chickens sold, 22,102,098 in number, were valued at $19,428,275. Of 188,335,897 doz. chicken eggs produced, valued at $50,726,843, 144,737,476 doz. with a value of $39,003,342, were marketed. The sheep industry yielded 6,499,451 lbs. of wool valued at $2,103,039. The state ranked fifth in honey produced with a total of 4,455,167 lbs. valued at $610,206.

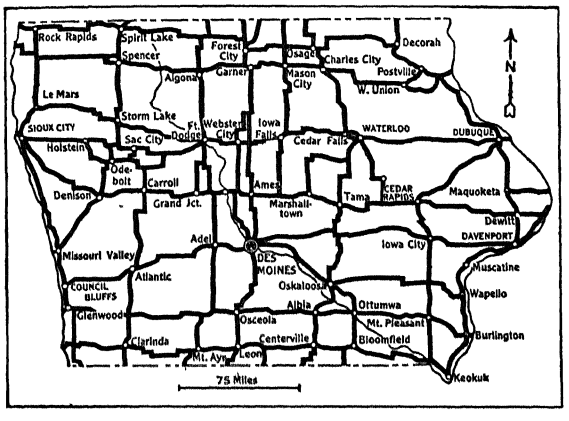
Fisheries. The fish catch in 1930 amounted to 8,680,000 lbs., valued at $404,000. The most valuable single take was that of mussel shells, all of which was absorbed by the button industry, which has its headquarters at Muscatine. Important species of fish include carp, sucker, catfish, buffalo fish and other Mississippi species. In 1930 the state issued 175,000 fishing licenses and received $175,000 in fees. Four hatcheries, operated by six men, cost $38,819 and their output included 330,124 trout, 8,120 bass and 55,000,000 other game fish.

The United States Bureau of Fisheries has several important Iowa stations having a huge annual output of fingerlings and yearlings. Plantings in Iowa waters

in 1930 included 55,000,000 catfish, 78,150,000 buffalo fish, 79,000,000 carp, 2,343,350 crappie, 9,100,000 sunfish, 17,000 trout, 270,000 bass, 175,750 perch, 175,450 pike and pickerel and 2,800,000 miscellaneous fish. During the annual overflow of the Mississippi River, the Federal Station at Bellevue rescued and returned to the river 35,699,277 fish, while the same organization at Marquette rescued 26,825,253.

Transportation. The Mississippi River affords a water route which is resuming activity as a result of the Federal Government's construction of a canal between Keokuk and Montrose and its channel improvements at Clinton. However, the steam railways provide the principal transportation facilities of the state. In 1930 Iowa had a total railway mileage of 9,709, the fourth largest mileage in the United States. The most important systems are the Burlington, the Milwaukee, the Rock Island, the Santa Fé, the Chicago & Northwestern, the Union Pacific, the Wabash, the Great Northern and the Illinois Central. This railway network is adequate for the region's requirements.

The highway system shows steady extension and improvement throughout the state. On Jan. 1, 1930,



IOWA STATE ROADS

there were 121,349 mi. of highways, including 18,021 mi. of surfaced roads and 5,822 mi. of state highways. The total highway expenditure during 1929 was $59,548,148, of which $34,772,545 was paid by the state and $24,775,603 by county and local governments. The state gasoline tax produced a gross revenue of $10,584,068 in 1930. Motor vehicle registrations were 778,386 in 1930, compared with 659,202 in 1925. The rapid growth of trucking facilities is attested by 1930 truck registrations, which were 72,190, compared with 45,790 in 1925, an increase of nearly 58%. During the same five-year period, the number of buses in operation increased from 1,301 to 1,952, or about 50%.

Manufactures. Although the industrial interests are predominantly agricultural, the state has substantial manufactures based on the utilization of the products of its farms, mines and quarries. Moreover, manufacturing has steadily expanded during recent years, the Census of 1930 showing a 20% increase in value of products over that of 1925.

According to the Census of 1930 Iowa with manufactures for 1929 valued at $898,213,272 stood seventeenth among the states. Its 3,317 establishments gave employment to 15,736 officers and employees, who received $34,916,521 in salaries and to 81,678 wage earners, who were paid $102,326,738 in wages. These factories used a total of 366,760 horse power, expended $18,062,503 for fuel and power, and $556,331,226 for materials and supplies, and added by the process of manufacture $323,819,543 to the value of their output.

These manufactures included about 90 separately enumerated groups of products. Among these the state stood first in washing machines, second in butter and fourth in meat packing. The major products were packed meats valued at $244,725,776 and butter, $96,956,244, which together constituted 38% of total factory output of the state. Other important products were printing and publishing, $36,484,332; washing machines, $29,738,317; corn sirup, sugar, oil and starch, $29,054,772; steam railroad car-shop construction and repair, $26,686,613; foundry and machine shop products, $25,755,878; bread and bakery products, $25,016,214, and dressed poultry, $22,839,901.

The principal manufacturing cities with value of products were: Sioux City, $133,576,118; Des Moines, $98,905,779; Cedar Rapids, $94,636,038, and Waterloo, $85,490,809.

Commerce. According to the census of 1930, there were in 1929 4,954 wholesaling establishments in Iowa with total sales of $1,056,984,912. These organizations gave full time employment to 27,603 men and women whose annual salaries aggregated $41,031,801. The chief wholesaling centers are Des Moines and Sioux City, with Cedar Rapids and Waterloo also important.

The total sales of the 32,991 retail stores amounted to $976,154,704. Sales per store averaged $32,991; sales per capita were $395.05.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	*No. of Stores*	*Sales*	*% of Total*
Automotive	7,195	$226,304,745	23.17
Food	6,885	175,086,573	17.93
General Mdse.	3,196	169,160,267	17.32
Lumber & Bldg.	2,969	104,168,553	10.66
Apparel	2,243	66,911,001	6.86
Furn. & Household	1,129	35,670,733	3.66
All other stores	9,374	198,852,832	20.40
Total, all stores	32,991	$976,154,704	100.00

Finance and Banking. The taxable value of all Iowa property in 1930 was $974,309,660. The basis of assessment was 25%. The total bonded debt was $14,202,043. Total revenue receipts in 1928 were $41,183,371, with the chief sources of revenue property and special taxes, $11,453,600, and licenses, including motor vehicle taxes and gasoline taxes, $4,638,577. Total expenditures were $40,648,389, with the principal items construction and maintenance of highways, $18,322,415, and educational aid, $796,987.

There were 1,229 banks in Iowa in 1930, of which 221 were national banks, 926 trust companies and state banks and 82 private banks. Their total capitalization was $61,875,000; their surplus and undivided profits $44,823,000. Total resources were $964,739,000, with loans and discounts aggregating $564,875,000. Demand and time deposits totaled $783,818,000. Per capita demand and time deposits were $317.34; per capita savings deposits, $186.96. The total savings of $461,781,000 were owned by 772,344 depositors. National bank circulation aggregated $12,638,000.

Government. Legislative authority is vested in a general assembly consisting of a senate composed of 50 members and a house of representatives of 108 members, meeting in biennial sessions unlimited in duration. Senators are elected for terms of four years and representatives for two years. The supreme executive power is vested in the governor elected for a term of two years with a salary of $6,200 per annum. Other executive officers are the secretary of state, auditor and treasurer. The highest judicial authority, the supreme court, consists of seven judges elected for terms of six years at $6,000 per year.

Social Welfare Institutions. Iowa has a Board of Control for state institutions which is appointed by the governor and ratified by the senate. This board also supervises private institutions for insane and for friendless children. There is a soldiers' home at Marshalltown, a soldiers' orphans' home at Davenport, a home for children at Toledo and an institute for feeble-minded children at Glenwood. An industrial school for boys is located at Eldorado and one for girls at Mitchellville. The state maintains hospitals at Mt. Pleasant, Independence, Clarinda and Cherokee. At Woodward are a hospital for epileptics and a school for feeble-minded. The state tuberculosis sanitarium is at Oakdale. The hospital for female inebriates is at Mt. Pleasant and for male inebriates at Independence. The penitentiary is at Fort Madison. The reformatory for men is at Anamosa and for women at Rockwell City.

Education. The first school in the state was located near the present site of Keokuk in 1830, and the first school building was erected in Dubuque in 1833. More than 100 log school houses were established by 1846. In 1928 there were 12,133 public school buildings. In the elementary schools and kindergartens there were 441,924 pupils and in the secondary schools, 110,260 pupils. All children from 7 to 16 years of age are required to attend school for 24 consecutive weeks.

The number of persons 5 to 20 years of age attending school in 1930 was 571,228, or 76.7% of the population within the ages specified, as compared to 515,616, or 71.2%, in 1920. Persons 10 years and over unable to read and write in 1930 numbered 15,879, or 0.8%, as compared with 20,680, or 1.1%, in 1920. Iowa leads all other states in literacy.

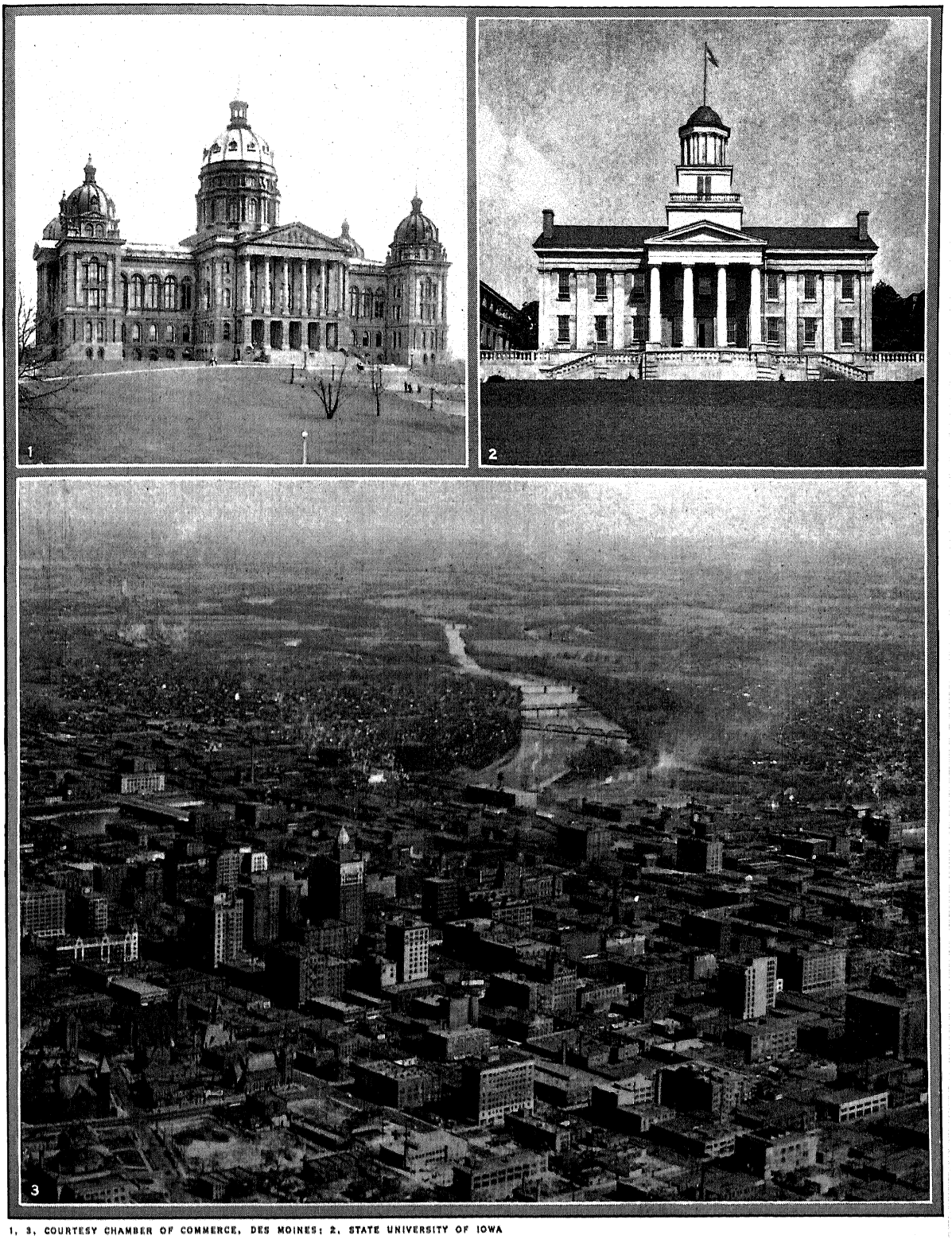
Of Iowa's 26 universities and colleges the leading state institutions are the University of Iowa at Iowa City, the Iowa State College of Agriculture and Mechanic Arts at Ames, and the Iowa State Teachers College at Cedar Falls. Among the important private institutions are Grinnell College at Grinnell, Cornell College at Mount Vernon, Drake University at Des Moines, Coe College at Cedar Rapids and Iowa Wesleyan University at Mount Pleasant. The Iowa Library Commission has its headquarters in the State Historical Building at Des Moines.

Population. In 1930 Iowa ranked nineteenth among the states with a population of 2,470,939 or an average of 44.5 per square mile, an increase of 66,918 or 2.8 from 1920. The population rose from 192,214 in 1850 to 2,231,853 in 1900, fell to 2,224,771 in 1910, and rose again to 2,404,021 in 1920. In 1930 there were 2,448,382 or 99.1% whites, 17,380 or 0.7% Negroes, 4,295 or 0.2% Mexicans and 660 Indians. Of the whites, 2,282,647 were native born and 165,735 were foreign born. Of the total foreign stock, including foreign born, and foreign and mixed parentage, 287,663 or 38.3% were German, 161,992 or 22.8% Scandinavian, 49,179 or 6.5% English, 47,192 or 6.3% from the Irish Free State. The rural population was 1,491,647 or 60.4% of the total, a decrease of 36,879 or 2.4% from 1920; the urban population was 979,292 or 39.6% of the total, an increase of 103,797 or 11.9% since 1920. In 1930 the seven largest cities were: Des Moines, 142,559; Sioux City, 79,183; Davenport, 60,751; Cedar Rapids, 56,097; Waterloo, 46,191; Council Bluffs, 42,048; Dubuque, 41,679.

Occupations. In 1930 912,835 persons, or 36.9% of the population, were gainful workers 10 years old or older; 82.1% of these were males and 17.9% were females; 90.4% were native white; 8.5% foreign-born white, and 0.9% Negro. In agriculture, the principal occupation, 330,881 persons were engaged; these included 212,108 farmers and 89,165 farm wage workers. Among other leading occupations, with number of workers, were manufacturing, 173,149, including 52,191 factory operatives and laborers and 14,556 carpenters; trade, 118,002, including 33,251 retail dealers and 39,631 salespersons; transportation and communication, 77,015, including 14,370 chauffeurs; domestic and personal service, 73,052; professional service, 68,732, including 30,015 school teachers, 3,733 men and 26,282 women; and clerical service, 51,116.

HISTORY

MARQUETTE and JOLIET in 1673 and HENNEPIN in 1680 visited the Iowa bank of the Mississippi. Julien Dubuque, attracted by the lead deposits, in 1788 founded the first white settlement in Iowa, abandoned in 1810 because of Indian hostilities. As part of the French domain, Iowa followed the changing fortunes of Louisiana: ceded to Spain, 1762; retroceded, 1800; purchased by the United States, 1803. The Iowa country was from 1805 to 1812 administered as part of the Territory of LOUISIANA; 1812-1821, of the Territory of MISSOURI; 1834-1836 (after a period without organization) of the Territory of MICHIGAN; 1836-1838, of the Territory of WISCON-



1, 3, COURTESY CHAMBER OF COMMERCE, DES MOINES; 2, STATE UNIVERSITY OF IOWA

IOWA'S STATE CAPITOLS AND LEADING CITY

1. State Capitol at Des Moines. 2. West approach of the old State Capitol, Iowa City, now a part of the State University of Iowa. 3. Air view of Des Moines, showing the Des Moines River running through the city.

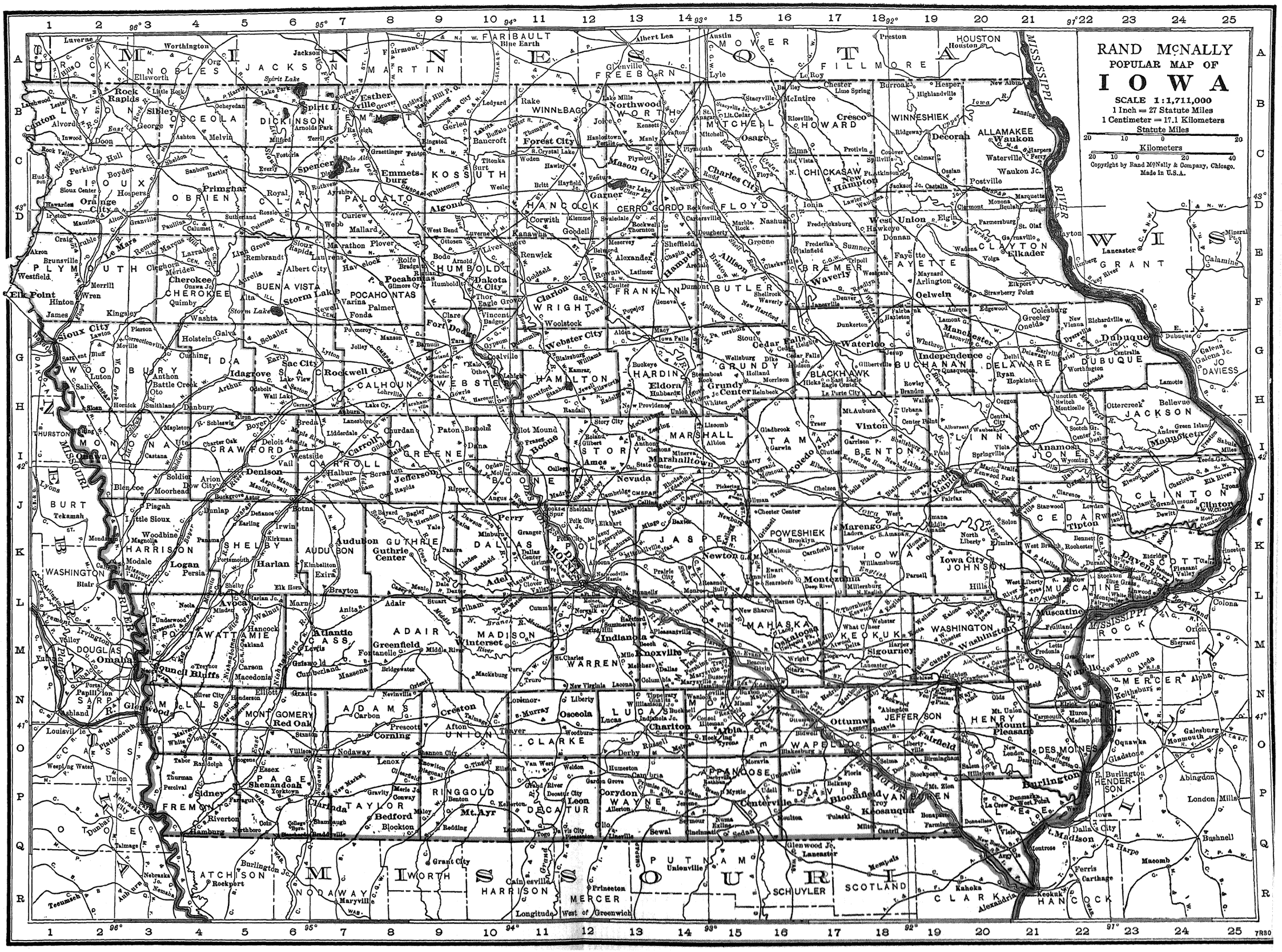
IOWA

Area 56,147 sq. m.
Pop. 2,470,939

PRINCIPAL CITIES

Pop.—Thousands

4 Albia.....O 15
4 Algona ...D 10
10 Ames.....I 12
4 Anamosa...I 21
6 Atlantic...M 6
3 Belle PlaineJ 17
3 Bettendorf L 24
12 Boone.....I 11
27 Burlington P 22
5 Carroll.....I 7
7 Cedar FallsG 16
56 Cedar Rapids J 20
8 Centerville P 15
5 Chariton..O 13
8 Charles Cy.D16
6 Cherokee...E 4
5 Clarinda...P 6
3 Clarion...F 12
3 Clear LakeD 13
26 Clinton....J 25
42 Council Bluffs M 3
3 Cresco....B 18
9 Creston....N 9
61 Davenport L 24
5 Decorah...C 19
4 Denison....I 5
143 Des Moines L 12
42 Dubuque..G 23
4 Eagle Grove F 11
3 Eldora....H 14
3 Emmetsburg C8
5 Estherville..B 7
7 Fairfield...O 19
22 Ft. Dodge.G 10
14 Ft.MadisonQ21
4 Glenwood..N 3
5 Grinnell...K 16
3 Hampton..F 13
3 Harlan.....K 5
4 Independence G 19
4 Indianola..M 12
15 Iowa City.K 20
4 Iowa Falls.G 13
3 Jefferson...I 9
15 Keokuk...R 21
5 Knoxville.M 14
5 Le Mars....E 2
3 ManchesterG20
4 Maquoketa I 23
4 Marion....I 20
17 Marshalltown I 15
23 Mason CityC13
2 Melcher..M 13
4 Missouri Valley.....L 3
2 Monticello H 21
2 Mount AyrP 10
4 Mount Pleasant O 20
17 Muscatine L 22
2 Mystic....P 15
3 Nevada....I 13
12 Newton...K 14
2 NorthwoodB 14
8 Oelwein...F 19
3 Onawa.....I 2
2 Orange CityD 2
3 Osage.....C 15
3 Osceola...N 11
10 Oskaloosa.M 16
28 Ottumwa..O 17
3 Pella.....M 15
6 Perry.....J 10
6 Red Oak...O 6
2 Rock RapidsB2
3 Sac City...G 7
2 Seymour..P 14
3 Sheldon....C 3
7 Shenandoah P 5
2 Sibley.....B 4
2 Sigourney M 18
2 Sioux CenterD2
79 Sioux City..G 1
5 Spencer....C 6
2 Spirit Lake.B 6
4 Storm Lake.F 6
2 Stuart.....L 9
2 Sumner...E 18
3 Tama.....J 16
2 Tipton....K 22
2 Toledo....J 16
4 Valley Junc.L11
2 Villisca.....O 6
3 Vinton.....I 18
2 Wapello...N 22
5 Washington M 20
46 Waterloo..G 17
3 Waukon...C 20
4 Waverly...F 16
7 Webster City G 11
2 W. Liberty L 21
3 W. Union.D 19



SIN. On June 12, 1838, Iowa received its own territorial organization. Already American settlers were established at Ft. Madison, founded in 1832 on the site of a military post, at Burlington and at Dubuque. As, after the BLACK HAWK WAR, the Sac and Fox Indians, who had displaced the Iowa and Illinois tribes, were forced to remove westward, an influx of pioneers brought the population of Iowa in 1840 to 43,112. Moves toward statehood were defeated at the polls in 1840 and 1842, for motives of economy; meanwhile, by "claim associations" and other informal organizations, the settlers maintained remarkably efficient local government. In 1844 a state constitution was framed and adopted; with its boundaries restricted to the present limits, Iowa was admitted to the Union on Dec. 28, 1846. Iowa City, which in 1839 had succeeded Burlington as the territorial capital, remained the state capital until in 1857, by an arrangement which awarded the state university to Iowa City, Des Moines became the political center. The last Indian claim to Iowa lands was extinguished by the federal Government in 1843. An Indian uprising near Spirit Lake and the Okoboji Lakes, in Dickinson County, 1857, in which about 30 whites were killed and habitations razed, temporarily retarded the growth of that region (*see* SPIRIT LAKE MASSACRE). Orderly expansion, with agricultural and livestock enterprises enlisting the great majority of the settlers, characterized the state. The rapid construction of railroads across Iowa to join the Union Pacific at Council Bluffs accelerated the increase of population. Although at times dominated by liberal and agrarian factions, Iowa has usually been Republican in both local and national politics. In 1932, however, the state gave its 11 electoral votes to Roosevelt and elected two Democrats, Louis Murphy and Clyde Herring, senator and governor.

BIBLIOGRAPHY.—B. F. Gue, *History of Iowa from the Earliest Times*, 4 vols., 1903; Cyrenus Cole, *History of the People of Iowa*, 1921.

IOWA, STATE UNIVERSITY OF, at Iowa City, Ia., a coeducational state institution, organized in 1847. When the state capitol was removed from Iowa City to Des Moines in 1855 the former state house and its grounds were given to the university, and the institution was opened there the same year. Until 1860 the university maintained only a normal department, but since the establishment of the original College of Liberal Arts in that year, has added colleges and schools of Law, Medicine, Dentistry, Pharmacy, Applied Science, Education, Commerce, Music, Journalism, Nursing, Religion, a Graduate College, Child Welfare Research Station and Division of Maternity and Infant Hygiene. The university is supported principally by appropriations made biennially by the state legislature. The library contains 855,104 volumes. In 1931-32 there were 9,900 students, and a faculty of 683 headed by Pres. WALTER ALBERT JESSUP.

IOWA CITY, a city in southeastern Iowa, the county seat of Johnson Co., situated on the Iowa River, 27 mi. south of Cedar Rapids. The Chicago, Rock Island and Pacific Railroad, bus lines, an interurban electric railway and an airport serve the city. Iowa City is surrounded by a rich farming and stock raising country and various manufactures are carried on, including principally toilet preparations, flour, iron and rubber products. In 1929 the factory output was valued at about $1,000,000; the retail trade amounted to $12,249,864. The important feature of the city is the UNIVERSITY OF IOWA whose seat was established here in 1847 by the state legislature. In 1868 the law department was established, in 1870 the medical, in 1882 the dental, in 1885 the department of pharmacy, the School of Education in 1907 and the School of Commerce in 1914. The administrative department occupies the old capitol building. Iowa City was founded as the seat of government for Iowa territory in 1839. Pop. 1920, 11,267; 1930, 15,340.

IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS, Ames, Iowa, a coeducational state institution established in 1858-62 and opened in 1868. It comprises colleges of Agriculture, Engineering, Home Economics, Industrial Science and Veterinary Medicine, and includes also a Graduate School and Summer Session. Four-, five- and six-year courses are offered, and special short courses are given in the winter. Research institutes are conducted in agriculture, engineering, veterinary medicine and industrial science. Its income in 1931 was $3,310,000. The library had 244,554 volumes. The enrollment in 1930-31 was 5,100, and its faculty of 509 members was headed by Pres. RAYMOND M. HUGHES.

IPECACUANHA (*Uragoga Ipecacuanha*), a valuable medicinal plant of the madder family. It is a small slightly woody perennial found chiefly in Brazil, where it inhabits moist forests. The semi-prostrate stem, which bears several oblong leaves and a small cluster of hairy flowers, rises from an irregularly ringed, somewhat beadlike rootstock. The dried rootstock forms the commercial drug ipecacuanha widely used in medicine as an emetic, expectorant, and diaphoretic, and also in the treatment of dysentery. The drug owes its properties to the powerful alkaloid emetine, found in the outer barky layer of the root. Various other plants possessing emetic properties are also known as ipecacuanha.

IPHIGENIA, in Greek legend, daughter of AGAMEMNON and Clytaemnestra. Agamemnon had angered ARTEMIS by killing her favorite hart. In revenge the goddess delayed the Greek fleet by sending a calm while it was in Aulis on its way to the Trojan War. Calchas, the seer, said Iphigenia must be sacrificed to appease Artemis. One version of the story says that this was done, another that a goat or hart was put on the altar in her place at the last moment and that Iphigenia was carried to Tauris where she became a priestess of Artemis. When her brother ORESTES and his friend Pylades came there she fled with them, carrying away from the temple

the statue of the goddess. Euripides made the story of Iphigenia the subject of one of his tragedies.

I PROMESSI SPOSI, a romantic novel by ALESSANDRO MANZONI. *See* BETROTHED, THE.

IPSUS, BATTLE OF (301 B.C.), a decisive battle fought at Ipsus in Phrygia by the rival successors of Alexander the Great. The contestants were Antigonus and his son Demetrius I of Macedonia on one side and a triumvirate consisting of Seleucus, Cassander and Lysimachus on the other. Antigonus was killed in the battle, and Demetrius withdrew to Ephesus to continue the struggle for supremacy. Meanwhile, the dominions of Demetrius were divided among the conquerors, and Lysimachus received the major part of Asia Minor. The battle marked the last serious attempt to unify the vast empire won by Alexander the Great.

IPSWICH, the county town of Suffolk, England, lying on a gentle hill above the river Gipping, 69 mi. northeast of London. Archaeological finds establish the fact of Roman occupation. During Saxon times it was pillaged by the Vikings. Many of its ancient buildings survive, among them Wolsey's gateway (1528) of Tudor brick, the only remaining fragment of the collegiate foundation established by the Cardinal in the town of his birth. Among other antiquities are Sparrowe's house in Butter Market with an interesting pargeted façade, and the churches of St. Margaret and St. Mary with their remarkable Tudor roofs. Several gabled and half-timbered houses survive. At Ipswich is the White Horse Hotel of Dickens's *Pickwick Papers,* and it was the birthplace of Sir Christopher Milton, the brother of the poet. David Garrick made his theatrical début in the town, and for many years it was Gainsborough's home. The modern city has engineering and agricultural implement manufactures, and artificial manure, paper, clothing, furniture, electrical apparatus and railway plant works. Pop. 1921, 79,371; 1931, 87,557.

IPSWICH, a town and village in Essex Co., northeastern Massachusetts. The village, a seaport and resort, is situated on Ipswich Bay, at the mouth of the Ipswich River, and is served by the Boston and Maine Railroad. The chief crops are apples, potatoes and truck. For many years Ipswich was the commercial and political rival of Boston. The old arched bridge which dates back to 1764, was the first of its kind in America. The old John Whipple House serves as the museum of the Historical Society. Pop, 1920, 6,201; 1930, 5,599.

IQUIQUE, the capital city of the province of Tarapacá in northern Chile. It lies on a narrow plain in a district rich in deposits of nitrate of soda and is an important shipping point for 28 nitrate *oficinas* employing 15,000 workers; some 1,200,000 tons of nitrate are annually shipped from the city. Schools, clubs, banks, business houses and municipal buildings, among them the government building, custom house and municipal theater, give to Iquique a modern aspect. The city was formerly a Peruvian possession, but was ceded to Chile by that country in 1803; it is known to Chileans for the battle fought there against Peru and Bolivia in 1879. It has several times suffered heavy losses from earthquakes and from tidal waves. Pop. 1930, 46,458.

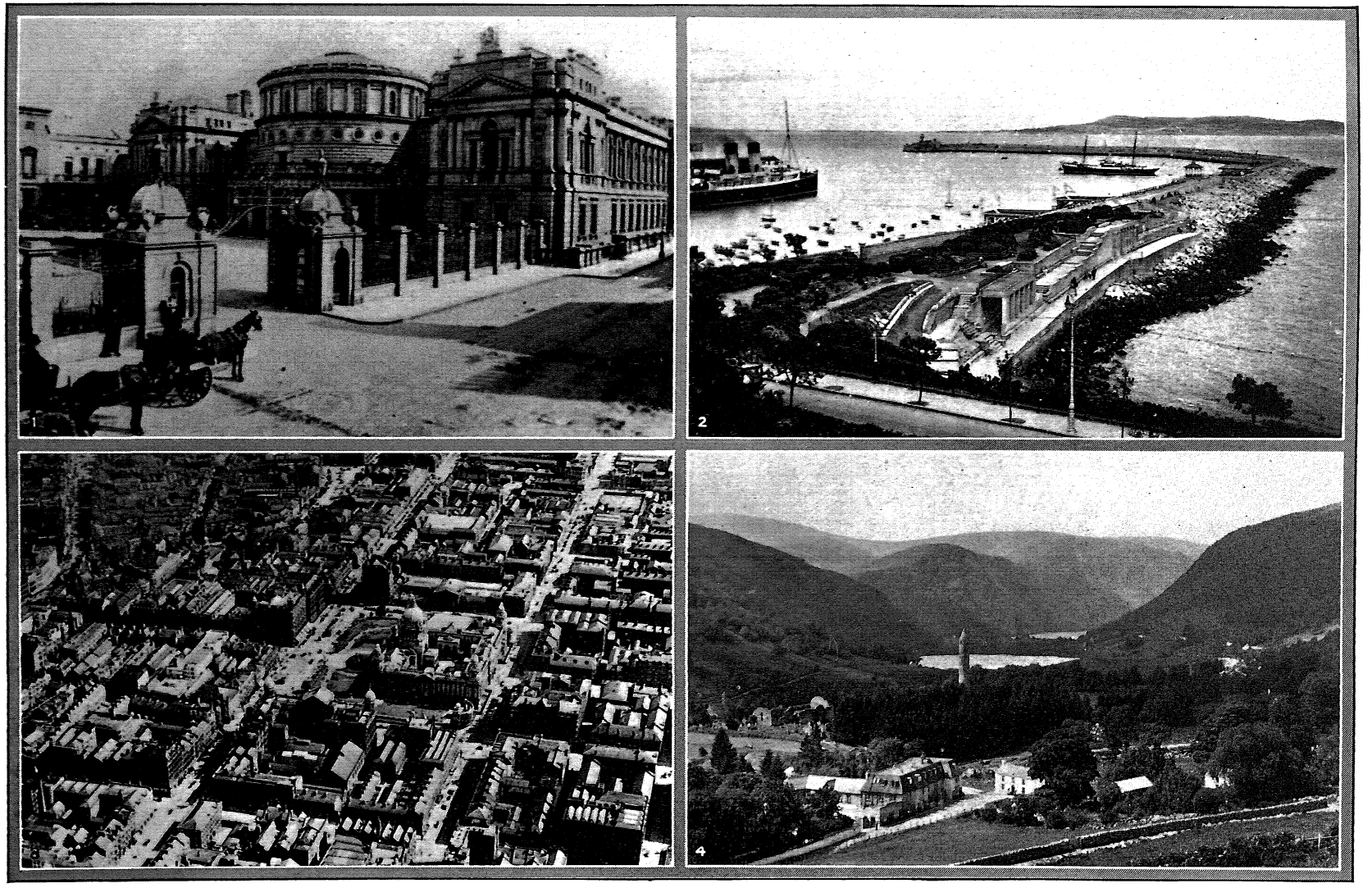
IQUITOS, a city and internal port of Peru, situated on the left bank of the upper Amazon, 600 mi. northeast of Lima. It is the capital of the department of Loreto and the shipping point for the district's products, which include rubber, straw hats, tortoise oil, cotton, wax, tobacco, vanilla and sarsaparilla. Brick and tile are manufactured. The city became prosperous when the gathering of wild rubber in the region was the most important industry. Est. pop., 1927, 30,000.

IRAN. *See* PERSIA.

IRAPUATO, a city of Mexico, in the state of Guanajuato, at an altitude of 5,655 ft. above sea level about 161 mi. from Guadalajara. It is the geographical center of Mexico. Though an unprogressive city, it is an attractive one and has good public schools, some iron foundries and minor industries. It has an up-to-date club for business men and several churches. The surrounding country has rich black soil several feet thick and is famous for its luscious strawberries, grown throughout the year and offered for sale by noisy vendors at each incoming train. Irapuato was founded in 1547 by Charles V. Pop. 1930, 54,951.

IRAQ, an Arab kingdom of Asia bounded on the north by Turkey, on the south by Nejd and Kuweit, on the east by Persia and on the west by Syria and Transjordania. Area 143,250 sq. mi. Pop. 2,849,282. Apart from the Persians, Kurds, Turcomans and others on the borders, a considerable number of Jews in the cities, and the Indians who are recent arrivals, the population of Iraq consists almost entirely of Sunni and Shiah Moslem Arabs who form over 90% of the inhabitants.

The modern mandated Arab kingdom of Iraq was freed from the dominance of Turkey during the World War and comprises the former Turkish vilayets of Baghdad, Basra and Mosul. The country is mainly the alluvial valley of the Tigris-Euphrates, bounded on the north and east by the plateau of Iran and on the south and west by the deserts of the tilted Arabian crustblock. The soil is very fertile, but water must be supplied by irrigation, since rainfall is insufficient. In the days of the Babylonian Empire there was a splendid system of dams, canals and channels that controlled the flood waters and stored and distributed them over the land converting it into a fertile region that yielded enormous crops of grain, fruit and vegetables. With the downfall of the great empires this fine irrigation system became derelict; the desert sand crept in and reduced the fertile area, the rivers got out of control and spread flood water and marsh, and the dry lands reverted to the natural condition of steppe, marsh and desert. Great modern irrigation works were constructed for the Turkish government by British engineers before the World War, but these works are but an infinitesimal portion of works which could be carried out. Ambitious schemes have been



1, 2, 4, COURTESY LONDON MIDLAND AND SCOTTISH CORP., NEW YORK; 3, EWING GALLOWAY PHOTO

CITIES AND TOWNS OF IRELAND

1. Science and Art Museum at Dublin (Baile Atha Cliath), capital of the Irish Free State. **2.** Dun Laoghaire Harbor (Kingstown), County Dublin, I. F. S. **3.** Aerial view of the center of Belfast, Northern Ireland, showing the Town Hall. **4.** Village of Seven Churches, Glendalough, Irish Free State.

IRISH FREE STATE

Area, 26,592 sq. m.
Pop., 2,957,000

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)

Pop.—Thousands

5 Arklow....L 22
7 Athlone....J 13
4 Athy....K 18
412 Baile Atha Cliath (Dublin) J 22
5 Ballina....G 7
5 Ballinasloe..J 12
2 Ballinrobe..I 7
3 Bandon....Q 9
3 Bantry....K 6
3 Birr....K 13
7 Bray....J 22
2 Cahersiveen P 2
2 Callan....M 16
7 Carlow....L 18
5 Carrick-on Suir....N 16
3 Cashel....M 14
4 Castlebar....G 7
3 Cavan....H 7
10 Cill Cainnig (Kilkenny) M 17
3 Clonakilty....Q 8
10 Clonmel....N 15
3 Cobh....P 12
78 Cork....P 11
4 Dalkey....J 22
13 Drogheda....H 21
14 Dundalk....G 21
35 Dungarvan....O 15
3 Dunmanway....Q 7
5 Ennis....L 8
5 Enniscorthy....N 20
7 Fermoy....O 12
14 Galway....J 8
3 Kildare....K 18
2 Kilkee....M 4
4 Killarney....O 5
4 Kilrush....M 6
4 Kinsale....Q 10
39 Limerick....M 10
3 Listowel....H 14
4 Loughrea....I 10
3 Mallow....P 13
3 Midleton....P 12
4 Monaghan....F 18
4 Mullingar....I 16
5 Naas....J 20
4 Navan....H 20
5 Nenagh....L 12
3 Newcastle....N 18
6 New Ross....N 18
Queenstown, see Cobh
2 Roscommon....I 12
3 Skibbereen....R 6
11 Sligo....M 14
5 Thurles....M 14
6 Tipperary....N 12
11 Tralee....O 4
3 Tuam....I 9
5 Tullamore....I 16
27 Waterford....O 17
4 Westport....H 6
12 Wexford....N 21
3 Wicklow....K 21
6 Youghal....P 14

NORTHERN IRELAND

Area....5,237 sq. m.
Pop....1,256,561

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)

Pop.—Thousands

7 Armagh....E 20
11 Ballymena....O 21
415 Belfast....D 23
8 Coleraine....B 19
5 Enniskillen....F 15
3 Larne....C 23
12 Lisburn....E 22
45 Londonderry....C 16
13 Lurgan....E 21
12 Newry....F 21
10 Newtownards....D 24
5 Omagh....D 16
12 Portadown....E 21
5 Strabane....C 16

proposed which the population of the country at present scarcely justifies.

The principal crops are rice, maize, millet, wheat and barley. Below BAGHDAD on the Tigris, and Hilleh on the Euphrates there are many date palms, which supply over 75% of the world's annual date crop. Mineral wealth is chiefly in oil and asphalt. Petroleum wells are yielding at Qaiyarah, near Mosul, and at Mandalj, near Baghdad. The chief asphalt deposits are at Hit. The largest city is Baghdad. Basra is the only port possible for large steamers, and Mosul is the metropolis of the north.

Iraq was placed under Great Britain as a mandate by the Treaty of Sèvres of 1920. The modern independent kingdom under King Faisal dates only from Dec. 14, 1927 when a treaty was signed between England and Iraq, whereby the former recognized the complete independence of the latter.

The name Mesopotamia, often used as if it were synonymous with Iraq, means "between the rivers" (Greek *meso* = between, and *potamos* = river).

IRELAND, JOHN (1838-1918), American Catholic archbishop, was born at Burnchurch, County Kilkenny, Ireland, Sept. 11, 1838. At 11 years of age, he went with his parents to the United States where they settled in St. Paul, Minn. After studying theology in France he returned to the United States in 1861, and was made chaplain of the 5th Minnesota regiment in the Civil War. After being vicar-apostolic of Nebraska and coadjutor Bishop of St. Paul in 1875, he was made head of the diocese in 1884, succeeding Bishop Grace, and was named archbishop in 1888. He did much to develop Catholic-church life in the northwestern part of the country, and by his liberal views on the destiny of the church in the United States, earned repute as a typical member of the American party of the Catholic Church. Among other works he wrote *The Church and Modern Society,* and took an active part in the total abstinence movement. He died at St. Paul, Sept. 25, 1918.

IRELAND, a large island lying west of Great Britain and separated from it by the Irish Sea which has the North Channel, 13 mi. wide, as an outlet on the north to the Atlantic, and St. George's Channel, 47 to 69 mi. wide, on the south. The island is washed on the north, west and south by the Atlantic Ocean. Its greatest length is 302 mi.; its average breadth 110 mi. It is divided into the four provinces of Ulster (north), Munster (south), Leinster (east) and Connaught (west), and subdivided into 32 counties. The area is 32,531 sq. mi. Formerly an integral part of the United Kingdom of Great Britain and Ireland, in 1922 the greater part of Ireland, 26 counties, was constituted the Irish Free State; Northern Ireland, comprising 6 counties, retaining a separate government.

The island consists of an extensive inland plain surrounded by a more or less continuous mountainous rim. The frequent and fairly wide gaps in the mountains, however, provide ready access to the seacoast in many places. This central plain is a drift-covered limestone lowland occupying about a third of the area. The surface is undulating, the main drainage being by the Shannon River toward the west. The poor drainage and moist cool climate have combined to promote the formation of peat bogs, which cover approximately a seventh of the country, mostly in the central plain.

As is well known, Ireland has been for the most part depleted of her population through famine. Between 1841 and 1851 it is estimated that 1,240,750 persons emigrated from the country. Adding to those the number who emigrated between 1851 and the end of 1901, Ireland's total loss from about the date of the great famine was 5,163,212 persons. After 1890 there was a falling off in the annual number of emigrants; nevertheless 461,000 persons left Ireland during the decade 1891-1900. After 1900 the rate for 25 years was about 50,000 annually, but this has decreased one-half. *See* IRISH FREE STATE; NORTHERN IRELAND.

IRELAND, HISTORY OF. The beginnings of Irish history are shrouded in myth and fable. Until 400 B.C. the country was probably peopled by the Pretani who also inhabited Britain, but at about that time they were invaded by the CELTS who established a Gaelic civilization which has never ceased to influence Irish life. Their society was composed of slaves, freemen and nobles, the last having a contractual relationship with their free clients who furnished goods and services in return for the cattle or capital provided by the nobles. There was also a privileged class of DRUIDS who specialized in law, religion, and learning. The political organization consisted of a collection of tiny states governed by kings and meetings of the nobles and freemen. The kings were elected from among the descendants of earlier kings. The small states often combined together and toward the end of the pre-Christian period there developed the office of high-king because of the rise to importance of the kings of Connacht, but it had slight political significance. It was then that the Irish developed a professional soldiery which raided the west coast of Britain and made some settlements.

The contact with Britain brought Ireland into touch with Latin civilization and Christianity but there was no marked progress in this direction until after the arrival of Patrick in 432 A.D. Latin learning spread from Wales, and monasteries were established so that in the 7th century the Druidic and Latin culture fused, slavery ceased to exist, and the Celts and their predecessors became indistinguishable. An extensive written literature developed and during the dark days of Europe, Ireland stood out by contrast as a shining light of civilization. The Northmen appeared at the beginning of the 9th century. Plunderers at first, they soon took islands and ports and a conquest was prevented only by the battle of Clontarf in 1014 in which they were defeated by the high-king, Brian Boru.

Yet, in the 12th century, Ireland was faced with a Europe which was becoming better ordered and pos-

sessed superior military methods. Pope Adrian IV gave Henry II of England the lordship of Ireland in 1155 on condition that he bring order into the Irish church and state. Irish disorder brought in Norman adventurers, at first as allies of an Irish king, later as conquerors, and with them came English institutions which conflicted with the Gaelic practices. Henry II came to Ireland and received the homage of most of the chieftains. A meeting of the Irish bishops accepted the forms of the Church of England. King John appointed a viceroy. Henry III extended English law and local government to Ireland, and Ireland had a parliament shortly after the development of that institution in England.

Such was the apparent progress, but folkways are more powerful than law. An insurrection aided from Scotland by Robert Bruce and led by his brother Edward in 1315 and the Black Death damaged the English colony. The old English stock was antagonistic to the new arrivals from England, and they came to identify themselves with the native Irish to such an extent that the Statute of Kilkenny in 1367 prohibited the intermarriage of the English and the Irish, forbade the English to use Irish law, and compelled them to speak English. Thus there was established the "Middle Nation," neither Irish nor English. There was much lawlessness in the country and during the Wars of the Roses, Ireland was saved from chaos only by the power of the three earls, Desmond, Ormond and Kildare, the last of whom was practically recognized as King.

Era of the Reformation. The English control returned with the Tudors. By Poynings's Law in 1494 the Irish Parliament was forbidden to meet without the King's consent or to consider legislation not previously agreed to in England. The loyal area was marked off as the Pale and the last of the Kildares were executed. These moves were not unwelcome in Ireland, and a thorough-going remedy of the abuses of the preceding period might have won support for Henry VIII's policy during the Reformation, but the religious change was pursued too earnestly. Moreover, after making himself King, instead of Lord of Ireland, he created the chieftains earls in exchange for the surrender of the ancient titles to their dominions, a procedure unacceptable to the other claimants under Gaelic law.

But the most important Tudor policy was that of plantation. The defiance of the Crown by Shane O'Neill, Earl of Desmond, and of some of the Ormonds, opened Ulster, Leinster, and Munster to colonization if Queen Elizabeth so wished. The first attempt in Munster was not successful because the immigrants were more interested in profits than settlement. Another opportunity came when O'Donnell, Hugh O'Neill, Earl of Tyrone, and James Fitzgerald rebelled with the aid of the Spanish. But James I, the new king, pardoned O'Neill and made Hugh O'Donnell Earl of Tyrconnell. These two chiefs found the arrangement little to their liking and in 1607 fled the country, an act which symbolized the end of Gaelic Ireland, for they were its last champions. Once again colonization in Ulster was possible, and though some of the Irish chiefs became landlords, the best land went to English and Scotch settlers who became supporters of the government while the old English element, recognizing this Protestant threat to their Catholicism and supremacy, went into opposition. The policy of Charles I created more trouble. He struck a bargain with the Catholics, promising them concessions if they provided him with £120,000. The concessions were never granted because of anti-papist sentiment in London, but the money was duly collected. The viceroy, Wentworth, outraged everyone with his drastic policy. Under the guise of remedying defective titles he collected huge fines. He insisted upon perfect conformity between the English and the Irish churches and nearly brought Ulster to rebellion by requiring the Black Oath which was aimed at the Scotch Covenenters in Ulster.

From 1641-49 Ireland was in rebellion, north and south. There were no great causes, only that everybody was opposed to everything. Ulster rose generally, and thousands of colonists were killed or fled. The attitude of the government forced all Catholics into one camp, a Catholic Confederacy was established, and the arrival of a papal nuncio increased the religious character of the war. Finally Cromwell himself came over and ended the whole affair, though peace was not concluded until 1652. The whole country was regarded as confiscated property and every Irishman who could not prove his innocence and his affection for the Commonwealth lost his property and in some cases his life. The Province of Connaught and the County of Clare were assigned to such Irishmen as could save any of their property rights. The rest of the country was given to the Cromwellian soldiers and adventurers. Thus there were established in Ireland two peoples whose opposition could not be founded upon any but the bitterest feelings.

17th and 18th Centuries. The Restoration helped the Catholics but little, for Charles II's hands were tied politically. Altogether about one-third of the disputed land was surrendered by the Cromwellians. Succeeding to these difficulties, James II looked to Ireland for assistance and called a parliament to remedy the grievances. But William III arrived, James was defeated at the battle of the Boyne, July 1, 1690, and the remaining resistance was stifled. The Irish leader, Sarsfield, agreed to the Articles of Limerick which guaranteed religious liberty and provided that those under arms might retain their estates or leave the country, but the Protestant Parliament refused to agree and the final settlement established the Protestant Ascendancy securely. This was done by the passage of the Penal Laws putting the Catholics under serious disadvantages. If the son of a Catholic father became a Protestant he inherited all the land, but if he remained a Catholic the land was equally divided among the children. The trades,

professions, education, and suffrage were denied Catholics. Later even the Presbyterians were discriminated against by the Episcopalian Ascendancy. Economic conditions became bad. The Catholics took to cattle raising and landlords evicted their tenants to use the lands for grazing. The Protestants were in turn harmed by legislation of the English Parliament, which, by seeking to keep the markets for English merchants, injured Irish interests. In order to control the growing indignation the government sought to control the Irish Parliament by bribery and patronage.

In the ranks of the Ascendancy arose the Patriot Party which, dealing with an embarrassed England, won many victories. The withdrawal of British troops on account of the American Revolution necessitated the formation of the Volunteers, who supported the Patriot Party until it effected the removal of the trade restrictions and the amendment of Poynings's Law, thus re-establishing legislative independence. But the resulting constitution did not give Ireland freedom, for the executive was not responsible to the Irish Parliament and the members of the Parliament might be corrupted by the administration. Popular discontent was rising and, with the failure of the Irish constitution, union with Britain appeared the only means of saving the power of the Protestant Ascendancy. The scheme was approved by a bribed Parliament. It provided for Irish representation in the Westminster Parliament through one hundred Irish commoners and thirty-two peers. Concessions to the Catholics, to which Pitt was morally obligated, were never granted.

The Period of Union. A new era was opening, however, with the growth of popular agitation. The Volunteers had shown a marked interest in French revolutionary doctrine. The Peep o' Day Boys were coming into conflict with the Catholic Defenders. Wolfe Tone formed the Society of United Irishmen and urged that Catholic and Protestant join together for the salvation of Ireland. With French assistance he attempted a rebellion which was put down with much violence. Whatever form the agitation took, it was based upon either agrarian troubles or the discrimination against Roman Catholics. By governing the country, Britain assumed responsibility for Ireland's ills, and the Irish had come to lay every grievance at the door of Westminster or Dublin Castle. All lines of agitation were then bound to converge in the demand for Irish independence.

Daniel O'Connell formed the Catholic Association in 1823. His objects were conservative, but he became impressed with the political possibilities of the organization and in 1828 he, a Roman Catholic, won a Parliamentary seat. Religious emancipation having thus become a political necessity it was granted. The nation had demonstrated its strength, and with the aid of the Young Ireland Party, which followed the revolutionary tradition, he turned to the repeal of the Union. His enormous meetings attracted wide notice until he surrendered when the government used coercion. The leadership then passed to the more radical Young Ireland Party.

The prosperity at the opening of the 19th century passed early, but the population increased at an extraordinary rate. Farms were too small, methods antiquated, and the management slovenly. Famine became acute in 1846. In a period of five years a million people died and an equal number emigrated. The landlords were ruined, and they, or the speculators to whom they were forced to sell their lands, presented the people with the alternative of rack rent or eviction. In this crisis the Tenant-Right League sought to secure fair rent, fixity of tenure, and free sale, while the Young Ireland Party attempted a futile rising in 1848. The payment of tithes to the Irish church ceased in 1869, the three F's of the Tenant-Right League were conceded in 1881, and by the legislation of 1885, and subsequent acts, land purchase through government loans to the tenants was on the way to completion in 1914. Yet the agrarian problem has never ceased to be a principal source of agitation.

After 1848 the nationalist movement was divided into several sections, which often competed for popular support. The Fenians, or Irish Republican Brotherhood, a secret military society, proposed to free Ireland by force. A series of popular leagues kept up agitation and voiced grievances. The Irish Nationalist Party in the British Parliament sought to gain concessions by parliamentary tactics, while it depended upon the popular organizations for support in elections. A literary renaissance revived the national tradition of Gaelic Ireland. A cooperative movement teaching Irishmen to look to their own resources for a solution of their problems had much influence. Isolated and without influence, was ARTHUR GRIFFITH who preached withdrawal from the Imperial Parliament and economic self-sufficiency, a policy known as SINN FEIN.

Revolution. The story of the Home Rule Bills properly belongs to British history. Beginning in 1870 the Irish in Parliament had urged this policy, and eventually they forced it upon the Liberal Party. The bills proposed in 1886 and 1893 failed. The third became law over the objections of the Lords in 1914, but the war came before it could go into effect. However, an act of 1898 had given local self-government.

On the eve of the World War Ireland's economic condition was vastly improved, but serious labor troubles in Dublin foretold the use of violence, and the Ulster Volunteers armed themselves to prevent the establishment of Home Rule. In the south the Irish Volunteers appeared. Redmond's appeal for support of Britain during the war removed the appearance of civil strife, but the Irish Republican Brotherhood brought together the labor leader James Connolly and the Volunteers in an insurrection in 1916. In 1917 Sinn Fein, as an untried policy, gave more promise than either physical force or constitutional methods, and the threat of conscription in Ireland brought such

support to the movement that the 1918 general election was a landslide to their candidates and instead of going to Westminster they met in Dublin as Dail Eireann. In the ensuing civil war, the forces of the government met assassination and boycott with terror and reprisals. Ulster organized her government on the basis of a statute establishing separate parliaments for the two sections, but never applied in the south. Finally, on Dec. 6, 1921, a treaty was signed providing for an Irish dominion from which Ulster might exclude herself, but EAMON DE VALERA and a minority of the Dail repudiated the agreement and a brief civil war commenced between his followers and the Irish Free State. Ulster decided to remain outside the new constitution and continued to operate the government established by the 1920 statute which gave her a parliament subordinate to that at Westminster. She has not since shown any inclination to enter the Free State. By the Statute of Westminster, 1931, the Irish Free State, along with the other dominions of Great Britain, acquired virtual independence.

Until 1927 De Valera's followers, though they constituted the second largest party elected to the Chamber of Deputies, refused to take their seats. In that year the government's legislation forced De Valera to come into the Chamber where he replaced the Labor Party as the principal opposition. The pro-treaty Government Party followed a moderate and usually constructive policy but, especially after 1927, it became more conservative and De Valera's Republican Party charged it with a pro-British policy and a failure to solve economic problems. The Republicans dropped their extreme position after entering the Chamber and emphasized the protective tariff as a policy. In the spring of 1932 they succeeded in electing De Valera President of the Free State. In Ulster the Protestant Conservative Government has remained in control and in legislation it has generally followed the path of the British Parliament. W. M.

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IRELAND, NORTHERN, a division of the United Kingdom. *See* NORTHERN IRELAND.

IRENE (752-803), a Byzantine Empress, was born in Athens in 752. In 769 she married Leo IV, Roman Emperor in the East. At his death in 780 she became regent of the Empire and guardian of her ten year old son, Constantine VI. Irene gradually usurped the supreme power, and dethroned and blinded her son in 797. She was overthrown in 802 by Nicephorus. Because of her work in restoring iconolatry and monasteries, she was canonized by the Greek Catholic Church. Irene died in exile in Lesbos on Aug. 15, 803.

IRETON, HENRY (1611-51), English general in the army of Cromwell, was born at Attenborough, Nottinghamshire, Nov. 3, 1611. At the outbreak of the civil war in England in 1642, he entered the Parliamentary army as captain. He served under Manchester in 1644, and became in 1645 commissary-general. He was wounded at Naseby. In the same year Ireton became member of Parliament. Favoring at first a settlement between the King and Parliament, he became Charles' enemy and was a member of the court that signed his death warrant. In 1646 Ireton married the daughter of Cromwell, who held him so high in his estimation that in 1648 he took Ireton with him when he sailed to subjugate Ireland. Ireton remained there as Lord-Deputy after Cromwell had left for Scotland, and completed the devastation. On Oct. 27, 1651, Ireton proceeded to the capture of Limerick. His success was brief. He died there on Nov. 26, 1651.

IRIDIUM, a chemical element belonging to the platinum metals, symbol Ir, atomic weight 193.1, and in the metallic state it has the greatest specific gravity of any substance, 22.4. It is white in appearance, very hard but brittle, melts at 2260° C. It was discovered by Tennant in 1804. It occurs in many platinum ores, and also alloyed with osmium, in osmiridium. It is used extensively in alloys to give hardness, as with platinum.

IRIGOYEN, HIPOLITO (1852-), President of Argentine, was born in Buenos Aires and educated in the College of San José. He read law, became interested in sociological and political studies and succeeded his uncle, Leandro Alem, as leader of the Union Civica Radical, the middle class, opposition and "reform" party in Argentina. In 1916 after the adoption of the secret compulsory voting law of 1912 he was elected president, and his party first came into power. He is considered the first man of the people to become president of the Argentine republic. He was an ardent nationalist and isolationist, kept Argentina out of the World War and made no special effort to cultivate the friendship of other nations. He served until 1922 and was reelected in 1928 at the age of 76, but a revolution late in 1930 overthrew him. Among the reasons given were his disregard of constitutioned procedure, and the increasing financial and administrative paralysis of his government. Irigoyen lived an unostentatious life in a simple room, and sedulously avoided publicity, but exerted a magnetic influence over the followers. He has been called "the last of the caudillos."

IRIS, in Greek mythology, daughter of Thaumas and the ocean nymph Electra, was a messenger of ZEUS and HERA, and the personification of the rainbow. By cutting off a lock of their hair, she released the struggling souls from the bodies of all women who died an untimely or unnatural death, as by suicide. She is represented in art carrying a wand and a pitcher, the latter symbolizing the ewer of water from the Styx with which she lulled the gods to sleep.

IRIS, an opera in three acts by Pietro Mascagni, libretto by Luigi Illica; première, Rome, 1898, Philadelphia and New York, 1902. Next to *Cavalleria Rusticana* the work is the most successful of Mas-

cagni's compositions. The background of the opera is Japan.

A young and beautiful Japanese girl, Iris, is courted by the profligate Osaka. As she remains aloof in her



CRESTED DWARF IRIS
Iris cristata

purity and her devotion to her blind father, Osaka plots to abduct her, securing the aid of Kyoto, who conducts a resort called the "Green House." By



GERMAN IRIS (*Iris germanica*)

leaving money behind Osaka makes the abduction legal, but Il Cieco, the girl's blind father, believes that his daughter has left him voluntarily. Enraged, he starts in pursuit of her, finding her at last as an inmate of the "Green House" to which Osaka left her when his interest dwindled. Infuriated by what he supposes is his daughter's deliberate treachery, the blind father flings mud at her. Iris, in amazement and terror, leaps from a window to her death.

IRIS, the typical genus of the iris family of plants, chiefly natives of temperate climates, many of which are widely cultivated for their showy flowers. More than two-thirds of the 168 species listed by the American Iris Society together with very numerous varieties are grown in American gardens, although many of them to only a small extent.

The cultivated or horticultural irises are comprised in three general groups; namely, Bearded Irises or *pogoniris,* Beardless Irises or *apogoniris,* and Crested



SPANISH IRIS (*Iris Xiphium*)

Irises or *evansias.* Differing from the foregoing are various bulbous species not commonly grown. Varieties of the bearded group, many of them popularly but erroneously known as "German" iris, comprise the common forms derived from southwest Asian and south European species; some of these in cultivation for more than 200 years. They are distinguished by their strap-like leaves, bearded lower petals or "falls," and their rhizomatous roots which stand continued exposure to air, sun and drouth without injury. The beardless varieties derived from European, Asiatic and American species, have fibrous-rooted rhizomes and will not endure long exposure. The leaves are more grass-like than those of the bearded and the flowers have no beards. The bulbous species, though popular in Europe, are not generally obtainable from American nurseries.

Bearded irises do best in airy situations, full sun and well-drained soils, made so when necessary by the addition of sand, ashes or mortar waste. They resent manure, damp mulches, shade, overhanging plants, and the covering of their rootstocks with soil. After blooming they enjoy drouth. When, usually after three or four years, the plants become crowded, they should be dug up after flowering, broken apart and reset in new places. Beardless species and varieties seldom need lime or transplanting but require moist soil, especially through and following the blooming period. They are also improved by liberal manuring. Bulbous and Spanish irises are best planted in autumn in sunny, well-drained situations and good garden loam, lightened when necessary with finely sifted coal ashes. English irises, planted in August



JAPANESE IRIS (*Iris Kaempferi*)

and September, will stand partial shade and moister soil than the preceding.

By judicious selection of species and varieties a season of nearly four months of bloom with few breaks in continuity may be had in the garden. In the neighborhood of New York City *Iris pumila* and *I. chamæiris* and their multicolored hybrids begin the season in late April, then *I. cristata* blue with a gold crest and later *I. lacustris,* a darker shade; *I. tectorum,* soft blue or white, follows, and *I. aphylla* (purple) soon after. In early May *I. cengialti* appears with fragrant, blue blooms; *I. kochii* in regal purple follows. Then appears the white *I. albicans* and the varieties Ingeborg, Ivorine and Zua, the violet Kharput, blue Walhalla and Purple King and creamy yellow Hafdan and Helge. In late May come the so-called "Germans" whose varieties are legion, but especially *I. pallida dalmatica,* pale blue; Queen of May, a rosy lilac; *flavescens,* yellow, and White Knight. During June come the *I. sibirica* and *I. orientalis,* white and blue varieties, and in July the regal *I. Kaempferi* or Japanese varieties, especially snowbound (white), mahogany (dark purplish red) and pink progress (mauve pink). M. G. K.

IRIS, DISEASES OF. *See* EYE, AFFECTIONS OF.

IRISH FREE STATE, in Gaelic *Saorstát Eireann,* a coequal member with the other self-governing nations forming the British Commonwealth of Nations. It consists of the provinces of Connaught, Leinster and Munster, with three counties of Ulster, Cavan, Donegal and Monaghan. The state, as constituted in 1922, includes 26 of the 32 counties of Ireland, and has an area of 26,585 sq. mi. with an estimated population in 1926 of 2,971,992.

The provinces, counties and county boroughs with their populations are:

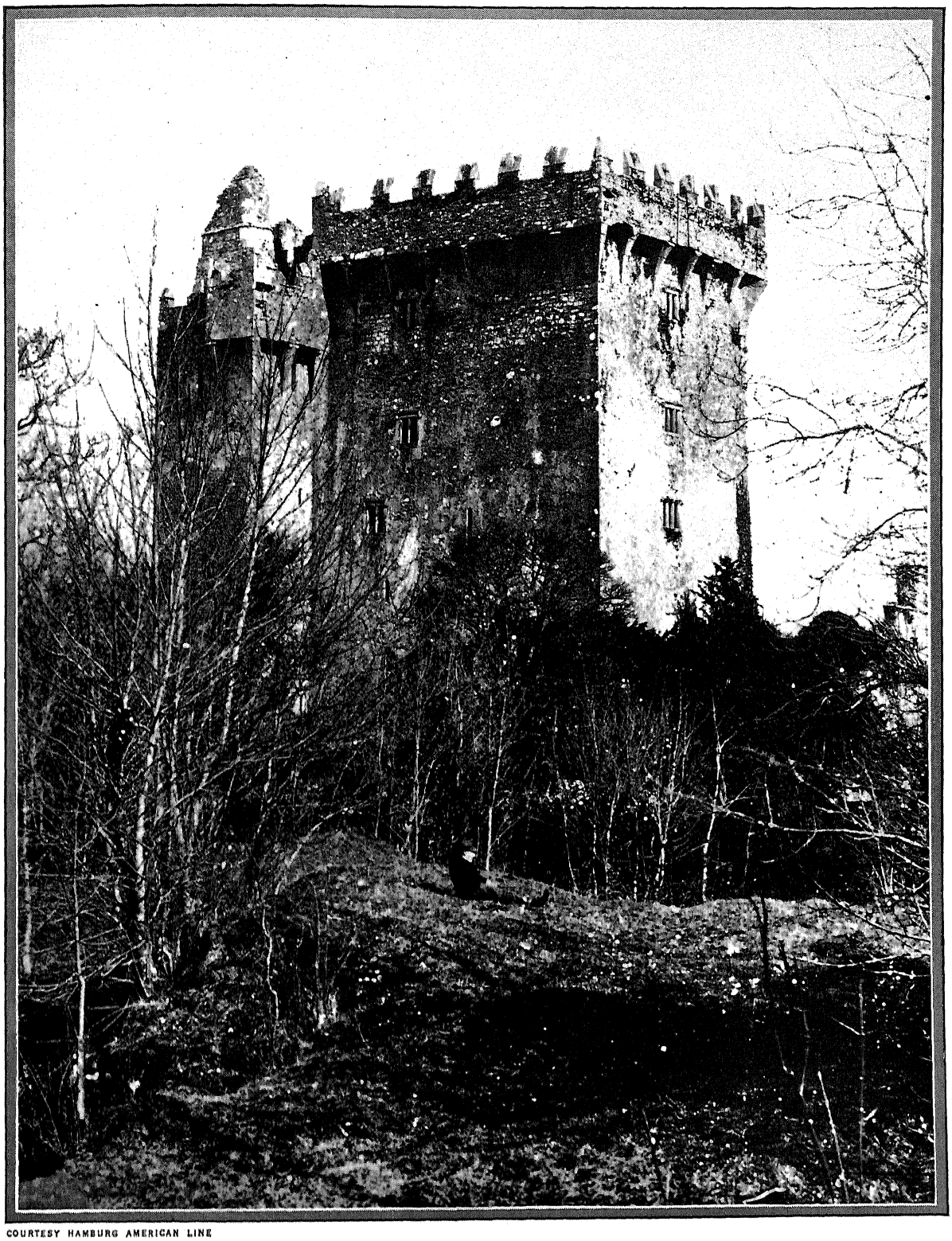
Province of Connaught	*Population 1926*
Galway County	169,366
Leitrim County	55,907
Mayo County	172,690
Roscommon County	83,556
Sligo County	71,388
Total	552,907

Province of Leinster	*Population 1926*
Carlow County	34,476
Kildare County	58,028
Kilkenny County	70,990
Leix (Queens) County	51,540
Longford County	39,847
Louth County	62,739
Meath County	62,969
Offaly (King's) County	52,592
Westmeath County	56,818
Wexford County	95,848
Wicklow County	57,591
Dublin County	188,961
Dublin (County Borough)	316,693
Total	1,149,092

Province of Munster	*Population 1926*
Clare County	95,064
Cork County	287,257
Cork County Borough	78,490
Kerry County	149,171
Limerick County	100,895
Limerick County Borough	39,448
Tipperary County	141,015
Waterford County	51,915
Waterford County Borough	26,647
Total	969,902

Province of Ulster (Part of)	*Population 1926*
Cavan County	82,452
Donegal County	152,508
Monaghan County	65,131
Total	300,091

Surface Features. The larger part of the region is the central plain, a great limestone plain covered with impervious clays of glacial origin, so that bogs cover very large areas. Where bogs are absent the soil is fertile. The southwestern part of the Free



COURTESY HAMBURG AMERICAN LINE

BLARNEY CASTLE IN COUNTY CORK, IRELAND

Blarney Castle, built in the 15th century, is famous for the "Blarney Stone," a smooth slab embedded in the battlements. According to the legend the stone gives the "gift of tongues" to all who kiss it.

State is built up of a series of mountain ridges with an east-northeast-west southwest trend. In the west the sea has invaded the valleys as long, narrow *rias*. Rias differ from fiords in that glacial action has played no part in their formation, and there is no submerged ridge near the entrance. The highlands in the northwest have a poor, thin soil. In the southeast is an upland region with a mass of granite forming the lofty Wicklow Mountains.

In ancient times Ireland was plentifully planted with forests, traces of them having been found on the mountains. In cutting peat, or "turf" as the natives call it, the remains of countless oaks and firs have been brought to light. The destruction of the forests has, of course, largely contributed to the formation of bogs, which consist of mosses, chiefly *Sphagnum,* and other lowly vegetable forms that take root in stagnant pools and hollows, and go on decaying underneath and growing at the top, always holding in suspension a greater or less quantity of moisture. The bogs on the plains are known as red bog, in contradistinction to the less deep and drier black bogs which grow in the mountainous parts. The predominating color is, however, a sombre brown rather than red; and it varies greatly in concentration and consistency. When the bog becomes sufficiently dry and consolidated, it yields peat, in the absence of coal the principal fuel of the poorer people. Bogs cover over 1,000,000 acres of the surface of the Free State. The Bog of Allen, for instance, lies over a great part of Offaly and Westmeath counties. It is estimated that the 6,000,000 tons of peat removed annually from all the bogs only equal the new growth. The heating power of the reserves is equivalent to about 2,500,000,000 tons of good coal.

Rivers and Lakes. The SHANNON, the longest river in the British Isles, rises in the hills to the north of the central plain and flows southwards across it to the Atlantic, which it enters by a long and magnificent estuary. From Lough Allen, at a height of 200 ft., the river winds a slow course, widening out at intervals into long shallow lakes studded with beautifully wooded islands. The largest of these lakes are Ree and Derg, occupying hollows dissolved out of limestone. Between Loughs Allen and Derg, a distance of 200 mi., the river falls barely 100 ft. A few miles below the latter lake there are falls and rapids which can be avoided by following a canal. The usefulness of the river is increased by its connection by canal with Belfast, Dublin and Waterford, and a gigantic scheme is under way to utilize the fall of the Shannon to generate electricity for nearly the whole State. The power stations began to supply current during the winter of 1929-30, and the authorities anticipated a consumption of current amounting to 144,000,000 kilowatt hours in 1932. The total cost of the undertaking will be approximately $35,000,000. The east-west direction of the great earth folds in the south of Ireland have in the main determined the direction of the rivers, Bandon, Lee, Blackwater and Suir. The celebrated Lakes of KILLARNEY, with their picturesque islands, promontories and ruined buildings, lie in a deep highland basin of the mountains of Kerry. There are three lakes; the largest, Lough Leane, or the lower lake, a sheet of water 5 mi. in length by 3 mi. broad, is dotted with some 30 islands and islets. The charm of these lakes is due to the blending of mountain and lake, wood and running water, and owes no small measure of its effect to the wealth and variety of the vegetation. The *Arbutus Unedo* is indigenous here, and ferns grow in great profusion. The scars on the mountain sides show through a tangle of greenery, and their feet dip into the waters below; and where the woods fail, their place is taken by an emerald setting of soft green grass. The waters which gather into these mountain reservoirs are carried into Dingle Bay by the River Laune.

Ancient Edifices. Ireland is famous for the great number of her small, ancient Celtic churches, which sometimes are grouped together in the mystic number seven. Examples still survive in part of Clonmacnoise, at Glendalough, on Scattery Island and other places. The State is noted also for beautiful stone crosses, at Monasterboice, Kells, Cong and more than 40 other places; and for numerous raths and duns (ancient forts), cromlechs, tumuli, stone circles and megalithic monuments. None of the many archaeological remains are of greater interest than the 80 round towers, constructed of stone and tapering as they ascend, which were built as places of safety and defense and date from the 9th on to the 13th century.

Climate. Ireland is the first land in Europe to benefit by the southwesterly winds from over the Gulf Stream and the Gulf Stream drift. In some cases, though to a moderate degree, their effects are neutralized by the great extent of the undrained bogs and morasses, and the general elevation of the central limestone plain. On the whole the climate of the Irish Free State is moist and equable; fogs, mists and drizzling rains abound, and the summers are cooler and the winters warmer than in other countries between the same latitudes. The mean annual temperature at Dublin is 49° F., at Valencia on the extreme southwest, 51°. At both, the range of temperature is very moderate. The weather is changeable, and squally winds by no means uncommon. The average precipitation for all Ireland is about 38 in. annually, though the southwest and west receive from 11 to 24 in. more than this. Except for New Zealand, Ireland provides the best example of an insular temperate climate.

Agriculture. Unlike Britain with its vast mines and factories, Ireland is lacking in the fundamentals of industrialism, so that whether they will or not the great majority of the Irish are compelled to be farmers. With the soil as the one great resource, its utilization is, on the other hand, rather narrowly restricted. The position to the west of Britain results in an even more pronounced marine climate. Furthermore, the saucer-like form of the surface, recently glaciated, a fairly heavy rainfall and low rate of

evaporation have resulted in extensive areas of poorly drained land, including much bog, a very real obstacle to progress in both agriculture and transport. In general Irish farms are small, averaging about 25 acres as compared with 94 acres per holding in England. Although too damp for many cereals, the climate of the Free State favors a luxuriant growth of grass with a large carrying capacity for live stock, the pivot of Irish agriculture. One-half of the cropped acreage is in hay and the emphasis upon the animal industries is very pronounced. The eastern counties have more fertile soil as well as more moderate rainfall, so that this is the chief region of tillage. Oats and barley are the principal cereals, while potatoes, raised chiefly as a supply crop, are grown everywhere. The introduction of the sugar beet industry has met with more than the expected success. The large yield and quality of the beet and of the sugar manufactured therefrom have proved the suitability of the Irish soil for this industry.

Animal and Dairy Products. The output of animals and animal products is valued at over four times that of crops. There are more cattle than people, and dairying is an important and growing industry with bacon, poultry and eggs important by-products. The proximity of the great markets in industrial Britain, particularly in South Wales and Lancashire, is of vital interest to Irish agriculture. Eight out of every ten of the cattle of the Free State are shipped alive to be fattened in Cheshire. The export of bacon, eggs and dairy products, especially butter, is largely to the industrial centers of England. The lack of an extensive meat-eating population and of a local market for by-products of the slaughter house has thus far discouraged the establishment of local meat-packing plants.

Fisheries. Until quite recently the fisheries were woefully neglected, although several varieties of fish, such as mackerel, herring, cod, ling, hake, sole, turbot, plaice, haddock, whiting, sprats, lobsters and oysters frequent the south and west coasts. On the west coast the fishing banks do not stretch far from shore, owing to the rapid descent of the submarine plateau on which Ireland stands; but on every other coast they reach far out to sea. In the 15th and 16th centuries these fishing grounds were worked by the Spaniards, the Dutch and, to a smaller extent, by the French. The Irish do not seem to have busied themselves with sea-fishing before the early years of the 19th century, when some fine fleets of boats were built and a hardy race of fishermen was evolved. In her inland waters Ireland possesses valuable fishing grounds for salmon in almost every river estuary, and for trout, pollan and eels.

Transportation. Two great canals cross the Irish Free State from east to west, both starting from Dublin, and both entering the middle course of the Shannon. The Grand Canal, which measures 166 mi. in all, has branches to several important towns in the midlands, and is continued beyond the Shannon as far as Ballinasloe. The Royal Canal is about 100 mi. long. By the amalgamation of 26 railways which were operative in the Free State, freight charges and passenger fares have been substantially reduced and more expeditious delivery of agricultural commodities has been achieved. There is a splendid system of steamers between Ireland and England. The chief Free State ports are DUBLIN, CORK, Cobh, WATERFORD and GALWAY.

Commerce. The chief imports are coal, wheat, maize, tea, automobiles, iron and steel, woolen garments and flour. The exports include cattle, sheep, pigs, butter, fresh pork, porter, beer and ale. The value of imports in 1929 was about $310,000,000, and exports about $250,000,000.

Nature has placed Ireland and Britain in close geographical contiguity, which begets for Ireland a relationship to Britain more intimate than that of any other member of the Commonwealth. This relationship is exemplified commercially by the extent to which Britain is a market for Irish commodities. For instance, 98% of the exports of the Irish Free State are consigned to Britain and Northern Ireland, and only 2% to all other countries. The value of the exports to Northern Ireland alone exceeds by five times the value of her exports to other countries, and is 20 times the value of her exports to the United States. Of the Irish Free State imports, 85% are consigned from Britain.

Religion and Education. The prevailing religion is the Catholic. The principal educational establishments are: Trinity College (Dublin University), the National University, with its three constituent colleges at Cork, Galway and Dublin; the Catholic University of Ireland, consisting of University College, Dublin and St. Patrick's College, Maynooth. Maynooth College, founded in 1795, is a famous seminary for the education of the Catholic priesthood. Secondary schools are under private control. Compulsory attendance at elementary schools holds only in certain cases; elementary education is free. The teaching of the Irish language is an essential part of the curriculum for all schools.

Government. Under the Free State constitution the region is governed by a parliament, *Oireachtas,* consisting of two houses, the Senate, *Seanad Eireann,* and the Chamber of Deputies, *Dail Eireann.* The Senate is composed of 60 members and the Chamber of Deputies of 153 members. The executive authority rests in the British sovereign. A governor general carries out Crown functions. Members of both houses of parliament must swear allegiance to the constitution of the Irish Free State, and to the British King.

IRISH LAND LAWS, THE, a series of acts passed by the British Parliament which since 1870 have changed land tenure in Ireland from a system of large estates to a condition of almost universal peasant proprietorship. Ireland, always predominantly agrarian, suffered severely during much of the 19th century from the unjust conditions of landholding to which its tenant farmers and cottiers were subjected. Closely related to the question of

Home Rule, the land problem in Ireland, which was first dealt with sympathetically by Gladstone, continued to be troublesome until the founding of the Irish Free State in 1922. In 1870 Gladstone had secured the passage of an act granting compensation to tenants for unjust evictments, and compensation to evicted tenants for improvements made on the land by them. In the following decade the movement of Irish Nationalism, of which Parnell became the leader, arose, and the IRISH LAND LEAGUE carried on continual agitation. In 1881 Gladstone, willing to accede to a large share of the demand for agrarian reform, achieved the enactment of a law giving the renter the coveted right to free disposal of his holding, much greater security of tenure, and assurance of impartial adjudication of what constituted a fair rent. Previous attempts in 1870 and in 1881 to secure provision for state aid to peasants for purchase by them of their holdings had failed. Henceforth, however, the conservatives sought to relieve Irish unrest, especially the clamor for Home Rule, by the promotion of land purchase acts. They sponsored the Ashbourne Act of 1885 which made a large grant to aid the peasants in the purchase of their holdings while an act of 1887 made eviction statutes more lenient. Due partly to the fact that for several years Irish landlords had not prospered and many estates were in the hands of courts or receivers, adherence to the policy of governmental aid for peasant purchase became general and the Purchase Acts of 1888, 1891, 1896 and 1902 were all designed to promote it. As a consequence, available land of Ireland has come into the hands of peasant proprietors.

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IRISH LAND LEAGUE, THE. The Irish National Land League was organized at Dublin Oct. 21, 1879, with the object of securing the reduction of rents and of facilitating peasant proprietorship. Its program was "Aggressive Moral force," and, particularly, agitation for new land legislation. In the confusion following the passage of the Land Act of 1881, which it supported, it carried test cases to the court and demonstrated the weakness of the act. The government, following a policy of repression, and the League were in bitter opposition until May, 1882, when Gladstone and Parnell reached an agreement and the latter withdrew his support from the League. In October the Irish National League was formed and replaced the older organization.

IRISH LANGUAGE, the chief language of the Goidelic branch of the CELTIC group of the INDO-EUROPEAN linguistic family.

It was spoken throughout Ireland, whence it was carried to Scotland in the 5th century A.D., and to the Isle of Man (*see* MANX) at an uncertain date. It has steadily yielded place to ENGLISH, which seems destined to supersede it, despite artificial attempts to revive it. It is now divided in Ireland into three dialectic groups: Munster (Counties Waterford, Cork and Kerry), Connaught (Counties Galway and Mayo, with the Isles of Arran), and Donegal; in Scotland, under the name of Gaelic, it is spoken at present only in the Highlands.

Irish proper, often called "Erse," has passed through four periods: Ogamic, with rather over 360 brief inscriptions in either OGAM or Roman characters, dating from the 5th and 6th centuries, and found chiefly in Ireland; Old Irish, from the 8th to the 12th century; Middle Irish, from the 12th to the 16th century; and Modern Irish, from the 16th century onward. Linguistically speaking, Irish is the most difficult of all the great Indo-European languages, especially because of the extensive changes undergone by its phonology, largely in consequence of a heavy stress-accent (*see* ACCENT) which has caused vowels to disappear with consequent assimilation or loss of consonants thus brought into juxtaposition.

The most important period scientifically is that of Old Irish, preserved chiefly in glosses on the Bible and Priscian, etc., in manuscripts at Milan, St. Gall, Würzburg, etc. The noun has here three genders, three numbers, and five cases; and the verb, three voices (active, deponent and passive), and indicative, subjunctive and imperative moods, the former having as tenses present, imperfect, future (three types), secondary future and perfect (also three types). The pronoun, when objective, is infixed between a prefixed particle and the verb; and in Old (not in Middle or Modern) Irish the verb (except in the imperfect) has two forms, absolute and conjunct, i.e., compounded with a preverb, as *berid,* "he carries," but *do-m-beir,* "he carries me"; while the first plural and the third singular and plural also have special forms for relative clauses, the sentence normally beginning with the COPULA, as Old Irish *is oc precept sosceli attó,* " 'tis a-preaching of the Gospel that I am." Certain of the linguistic phenomena seem so unlike those of other Indo-European languages that the influence of some non-Indo-European speech is frequently suspected. This earlier structure has been simplified in Middle and Modern Irish, but the orthography still gives little idea of the actual pronunciation.

L. H. G.

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IRISH LITERARY RENAISSANCE. *See* IRISH THEATER.

IRISH LITERARY THEATER. *See* IRISH THEATER, THE.

IRISH LITERATURE. *See* CELTIC LITERATURE; *also* ENGLISH LITERATURE.

IRISH MOSS, a dark-purple, leathery, fan-shaped seaweed (*Chondrus crispus*) known also as carrageen. The plant is very abundant on the shores of northwestern Europe and occurs also on North American coasts from Long Island to Labrador. The Irish moss

of commerce, used medicinally and as an article of food, is prepared by washing the plant and bleaching it in the sun.

IRISH NATIONALISTS. *See* THIRD PARTIES.

IRISH SEA, a body of water, approximately quadrilateral, bounded by Ireland on the west, Scotland on the north and by England and Wales on the east and south. It communicates with the Atlantic Ocean on the north by way of the North Channel and on the south by St. George's Channel through which it receives the tide. Its maximum breadth is 150 mi., between Dundalk Bay in Ireland and Morecambe Bay in England, and its maximum depth is 500 ft. The shallowness of the water along its shores creates high tides which are useful in filling the docks and scouring the channels of various harbors. Liverpool is the most important port on its shores. Within the sea are the islands of Anglesey, Holyhead and Man.

IRISH THEATER, THE. The Irish Literary Theatre was founded in Dublin in 1899 as part of the general movement of the period towards the emancipation of the theater from purely commercial preoccupations and outworn dramatic conventions. It owed its existence primarily to the efforts of Edward Martyn, GEORGE MOORE and W. B. YEATS, all of whom were interested in the "theater of ideas," Moore and Yeats having had plays produced by the Independent Theatre in London, which derived directly from the *Théâtre Libre* in Paris and the *Freie Bühne* in Berlin. With the assistance of LADY GREGORY, Standish O'Grady, and GEORGE RUSSELL, support was enlisted in Ireland for a theater which would correspond to the institutions mentioned, with the result that the Irish Literary Theatre made its début with *The Countess Cathleen,* May 8, 1899, by W. B. Yeats, and *The Heather Field,* May 9, by Edward Martyn.

Early the following year a second season followed with *The Bending of the Bough,* Feb. 19, by Moore, *Maeve,* Feb. 20, by Martyn, and *The Last Feast of the Fianna,* Feb. 19, a heroic drama of ancient Ireland, in which Alice Milligan joined with Yeats in upholding the Irish poetic drama as distinct from the works of their colleagues, which might be described as being in the Ibsen tradition. This distinction is important as it represented a divergence of aims which was to lead to the dissolution of the Irish Literary Theatre, and to make way for what was subsequently to be known as the Irish National Theatre. In the latter part of 1901 the Irish Literary Theatre terminated its official career with the production of *Diarmuid and Grania,* Oct. 21, 1901, by Yeats and Moore, and of the first Gaelic play to be performed in any theater, *Casadh an t-Sugain,* ("The Twisting of the Rope"), by Douglas Hyde. Although this final program was national in every literary respect, the Irish Literary Theatre lacked the essential condition of a national theater: all six plays in English had been performed by English actors.

That essential condition was furnished by a group of amateur actors known as the Irish National Dramatic Company, which had been founded and directed by the brothers Frank and W. G. Fay. This group of actors, trained by the Fays in the tradition which was to make the Irish Players famous, produced in 1902 *Deirdre,* by George Russell; and *Kathleen ni Houlihan,* by Yeats, and was formally recognized as the successor to the Irish Literary Theatre under the title of the Irish National Theatre Society. The year 1903 saw the arrival of J. M. SYNGE, the outstanding dramatic genius of the Irish Literary Renaissance, and the active participation of Lady Gregory in the new movement, from which Moore and Martyn had dissociated themselves. Lady Gregory's *Twenty-five* (Mar. 14, 1903), Synge's *In the Shadow of the Glen* and Padraic Colum's *Broken Soil* introduced for the first time three dramatists whose work was the measure of all that the Irish National Theatre subsequently achieved. Added to these folk plays came *The Hour Glass* and *The King's Threshold,* by Yeats, two of his most beautiful poetic plays, which thus completed the program at which the Theatre had aimed.

The year 1903 also witnessed the first tour abroad of the Irish Players, first to London, and then to America, under the auspices of the Irish Section of the St. Louis Exposition. This tour, while it resulted in a partial dispersal of the original group of players, had the advantage of focusing attention upon the remarkable abilities of the actors and playwrights, and of enlisting the financial aid of Miss A. E. F. Horniman, who provided the funds to rebuild and subsidize the Abbey Theatre in Dublin, "the first endowed theatre in any English-speaking country," as Yeats described it. From 1904 until 1910, with the assistance of Miss Horniman's subsidy, the Abbey Theatre fruitfully fulfilled its rôle as the Irish National Theatre. During those years, despite the attacks of political zealots and religious fanatics, there developed a school of acting which became famous all over the English-speaking world, and a school of dramatists whose names added luster to the great literary and intellectual revival in Ireland, usually referred to as the Irish Literary Renaissance.

While Yeats was interested primarily in the poetic drama, few of the dramatists most prominently identified with the Irish Theatre followed him in that direction. The plays which he desired for the national stage should tell the people of their own life, he postulated, "or of that life of poetry where every man can see his own image." The folk drama of such realists as Colum and Synge answered the former alternative and definitely turned the Irish Theatre to plays of rural life. The genius of Synge transcended the precise limitations of peasant realism, but his use of the Anglo-Irish idiom gave even to such fantasies as *The Playboy of the Western World,* Jan. 26, 1907, an air of contemporary reality which found a more prosaic equivalent in the plays of Colum, William Boyle, Lady Gregory, Seumas O'Kelly, T. C. Murray and Lennox Robinson. In the first decade of its existence the Abbey Theatre offered these writers a medium in

which all the comedy, tragedy, and even the melodrama of rural Ireland was presented in literary terms.

In 1911 a company was formed to take over the Abbey Theatre on the withdrawal of Miss Horniman's subsidy. When the Irish Free State came into being in 1921 the hope was entertained that the Abbey Theatre would become officially what it was in fact, a state theater. All that has been done in this connection has been that the Free State government has voted a small annual sum towards the support of the Theatre, in return for which a director, nominated by the Minister of Finance, has a voice in the selection of plays. The effect of this partial step towards government control has been to induce a more conservative attitude in the Abbey Theatre directorate than was observable in the 20 previous years of the Theatre's history. Less emphasis is now placed upon the peasant play, the work of European and of American dramatists receives attention, and the Theatre is now more like the original Irish Literary Theatre, as conceived by Martyn and Moore, than like the theater of the ten years preceding the World War, when the folk dramatists were names to conjure with.

The years of strife through which Ireland passed from 1913 until the end of the Civil War in 1923 have left their heavy mark upon the Irish Theatre as upon the entire literary movement which flourished from the beginning of the century until the World War. One figure alone stands out in this post-war period of an importance comparable to that of a Synge: Sean O'Casey, author of *Juno and the Paycock,* Mar. 30, 1924, and *The Plough and the Stars,* Feb. 8, 1926. O'Casey has done for the urban life of Ireland during the Civil War what Synge did for the rural life of western Ireland. The absence of the city from the entire canon of the Irish Theatre had hitherto been an anomaly, which has now been amply remedied by the plays of this bitter and exuberant realist, whose contempt for the polite fictions of Irish life has earned for him the same hostility which greeted Synge. In the case of both authors, fortunately, the Abbey Theatre directorate refused to be bullied, with the result that, even if its most glorious days may be said to be over, the Irish Theatre can boast of having given the world two of the greatest dramatists of modern times, J. M. Synge and Sean O'Casey. E. B.

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IRKUTSK, administrative center of the Eastern Siberian Region of the R.S.F.S.R. and formerly the capital of Irkutsk Province, situated in the southeastern part of this Region, on the Angara River about 43 mi. west of Lake Baikal. Irkutsk lies at an elevation of 1,500 ft. in a location favorable to its commercial development. The numerous waterways, the Angara, Baikal, Selenga and Upper Angara rivers, connect it with much of Siberia, particularly to the east of Lake Baikal. The city is on the Trans-Siberian Railway and has express railway service from Leningrad and Moscow. Although the river is frozen four months each year, good roads give the city access to the north and east at all seasons. Founded about 1652 as winter headquarters for the collection of a fur tax from the natives, it developed into an *entrepôt* for trade with China and the north. Irkutsk is a great fur purchasing center and is closely connected with the Lena gold regions. The focus of Eastern Siberian culture, this city has a state university, a scientific museum, various smaller museums, libraries, a normal school and theaters. Good streets, electric lights and modern sewerage are evidences of the progressive spirit of Irkutsk. It supports lumber mills, tanneries, breweries and fur coat making establishments. *See also* SIBERIA. Pop. 1926, 98,764.

IRON, a metallic element (symbol Fe, atomic weight, 55.84), distinguished as the most abundant and most useful of all metals. It occurs in the free state only in limited quantities in basalts and in meteorites. Combined with oxygen and other elements, it is widely distributed as a constituent of rocks, forming extensive deposits in many parts of the world. The chief ores are the oxides, hematite (Fe_2O), magnetite (Fe_3O_4), and the carbonate $FeCO_3$, siderite.

Iron is obtained from its ores by decomposing and reducing them in the BLAST FURNACE with coke and limestone. The iron obtained from the blast furnace contains 2.6 to 4.3% of carbon and some silicon and manganese. It may be further treated to increase its purity. Iron in the chemically pure state is a silvery white metal, very cohesive and ductile. It has a density of 7.86, melts at 1,530° C. and boils at about 2,450° C. Like all metals, in the solid state it is always crystalline. It crystallizes in the cubic system; one variety (gamma iron) existing between 900° and 1,400° C. possesses the face-centered atomic arrangement while at other temperatures the alternate form (alpha iron) has the body-centered cubic structure. It is one of the very few metals having alternate crystal forms—allotropy. This circumstance complicates its metallography and that of its alloys, but it is also responsible for the outstanding behavior of its alloys—that of hardening by rapid cooling. Iron of high purity, in the degree possible in many metals, is nearly unknown or a laboratory curiosity at best. Oxygen and carbon in one form or another persistently remain in iron, although they are greatly reduced by vacuum melting.

The magnetic properties of iron, and its ability to absorb carbon to give it varying degrees of hardness have adapted it to the many magnetic and structural uses to which it is put. Iron forms three oxides: ferrous (FeO), ferric (Fe_2O_3), and ferroso-ferric (Fe_3O_4). It forms two series of salts, ferrous (having a valence of 2) and ferric (having a valence of 3), corresponding to the ferrous and ferric oxides. Iron and compounds of iron are essential in blood formation, and in medicine find wide use as astringents or for treatment of anemias. The compounds chiefly

used are ferrous carbonate ($FeCO_3$); ferric chloride ($FeCl_3$), a commonly used astringent; and ammonio-ferric citrate.

WORLD'S PRODUCTION OF IRON AND STEEL

The following table is an estimate of the world's production of pig iron and steel for 1929 and 1930 (in thousands of tons).

Country	Pig Iron		Steel	
	1929	1930	1929	1930
United States	42,964	31,903	55,184	40,289
Germany	13,401	9,695	16,246	11,539
France	10,364	10,098	9,699	9,403
Great Britain	7,711	6,296	9,791	7,416
Belgium	4,096	3,394	4,132	3,375
Russia	4,322	5,005	4,907	5,638
Luxemburg	2,906	2,474	2,702	2,270
The Saar	2,105	1,912	2,209	1,935
Czechoslovakia	1,644	1,435	2,259	1,835
Italy	1,678	534	2,143	1,774
TOTAL (incl. all other districts)	98,080	79,670	119,040	95,385

ALLOYS OF IRON

Iron unites with even fractions of one per cent of carbon and nitrogen to form hard intermetallic compound particles (carbide and nitride), so that these are simple hardening agents conferring wear resistance upon the metal.

Larger amounts of silicon, phosphorus, tungsten, and molybdenum in pure iron likewise form hard brittle constituents and at least the iron tungstide and iron-molybdenide thus formed can be controlled as to particle size and distribution to develop valuable alloys.

Chromium, nickel, cobalt, vanadium and manganese can be added in extremely large amounts without introducing any new crystal substances and act largely to strengthen the pure iron without causing great hardness or brittleness.

Of all the alloys of iron, iron-carbon is the most important, for carbon is responsible for the well-known thermal hardening and tempering treatment, although large amounts of a few other elements contribute controllable thermal hardening properties. When other elements are added with carbon, producing alloy steels, a vast array of properties may be developed. In most cases it is the union of the carbon with the added element which influences the structure and hence the properties of the alloy steels.

The mechanism of the hardening of steel is somewhat as follows: Carbon, present as carbide, is quite insoluble in low temperature (alpha) iron, i.e., below 725° C. When the steel is heated to form the high temperature modification (gamma iron) the carbide dissolves therein to form austenite. Slow cooling will again produce carbide particles of varying size, depending upon the rate of cooling. Extremely rapid cooling suffices to prevent carbide precipitation due to inadequate time, but the allotropic change occurs and a unique supersaturated alpha iron results, which is glass hard (martensite). This constituent is too brittle for many purposes and is toughened by reheating at only moderate temperatures, which permits partial carbide precipitation and controllable softening. This process, with appropriate modifications for certain compositions, is common to all carbon or alloy steels. The outstanding influence of added elements upon the hardening of steel is to lessen the necessary rate of cooling (quenching), hence also to permit deeper penetration of the hardening into large steel sections. High alloy content even permits of hardening by air cooling (air hardening steels) and medium additions permit quenching in oil.

The following list shows the alloying elements commonly added for intensifying certain properties of steel.

Hardness: Few, if any, steels show hardness greater than is possible with plain high-carbon steels. The other elements serve rather to maintain nearly the same hardness with increased toughness.

Strength: In untreated steels most of the alloying elements increase strength, but nickel, chromium, manganese and silicon are outstanding. Strength is usually concurrent with hardness.

Wear Resistance: Due to forming harder carbides chromium and tungsten contribute wear resistance which is not parallel with hardness.

Toughness: As above, nickel and manganese in soft steels—chromium as well as small amounts of vanadium and zirconium in the hardened steels—seem to promote freedom from brittleness. The merit of steels has its chief basis in the combination of hardness and toughness.

Corrosion Resistance: Corrosion is definitely retarded by copper in small amounts well under 1.0%, but is hastened by large additions. Nickel in small amount may be of value, but small additions of other elements are of doubtful effect. Remarkable corrosion resistance is contributed by large chromium additions, over 11%, and such stainless steels are further improved by several per cent nickel; large additions of silicon are valuable in some cases.

High Temperature Use: Oxidation at high temperature is reduced many fold by high chromium content. Nickel therewith is likewise helpful. Silicon and aluminum contribute some resistance to oxidation at elevated temperature.

Strength at High Temperature: Ordinary steel softens and gradually deforms under low loads at high temperature. Large additions of chromium with or without nickel provide strength at high temperatures, particularly useful being 18% chromium with 8% nickel; and 22.28% chromium. Further tungsten additions increase high temperature strength.

Permanent Magnetism: A hardened steel retains magnetism but the remanence and coercive force of certain alloy steels is outstanding. Cobalt, tungsten, and chromium are the most important additions for this purpose.

Transformer Iron: Metal with high magnetic permeability and low hysteresis is required in motors,

transformers, etc. Coarse, well-formed soft-iron crystals are here required and low-carbon high-silicon (3 to 4%) steel is used.

Structural Steel: Plain carbon steel is generally adequate, and since a slight plasticity and reliability are paramount, it is largely medium carbon steel in soft condition. For some structures where weight is important, stronger alloy steels are used unheat-treated. Manganese, nickel and silicon are the principal additions.

For alloys used in tools, *see* TOOL ALLOYS.

The temperatures of inversion from one to the other form of iron mentioned above are progressively changed by alloy additions. The metallographist therefore classifies the alloying elements according to whether they lower the 900° C. critical point or raise it. The elements nickel, manganese, carbon, and the rare elements of the platinum group lower the transformation point and, indeed, in the case of nickel and manganese, this temperature may be so depressed by 25% and 15% respectively, that even at room temperature the iron alloy is in the austenitic state (gamma iron), particularly when considerable carbon is present. Stainless steel of 18% chromium and 8% nickel and Hadfield's manganese steel are of this sort. Deformation causes the allotropic change to occur and rapid hardening ensues. The elements chromium, silicon, tungsten, molybdenum, tantalum, vanadium, phosphorus, aluminum and tin exert the opposite influence and elevate this temperature until, if sufficient be added, the iron solution possesses no allotropy and is at all temperatures in the alpha form (ferrite). Such alloys are not thermally hardenable. With elements of both classes present intermediate effects result.

All steels harden with cold deformation and such operations as cold-drawing of wire induce amazing strength. Such wire may develop nearly 400,000 lbs. per sq. in. breaking strength. Piano wire and suspension bridge wire are of this general type. This method of producing strength in steel is extremely reliable since the process itself is a severe test of uniformity and soundness. E. C. BA.

IRON, ORNAMENTAL, usually referred to as "wrought iron," was distinctively English in its initial application. It is one of the older art-crafts, and from its first crude usage it developed in attractiveness and usefulness to its full charm in the 17th century. Some of the beautifully designed gates, fences and balustrades of that time are still preserved. The first steps toward decorative ironwork were taken in the chased and inlaid grills, locks and hinges made for the castles of feudal kings and barons; and in the ornamental chancels, grills and altar rails designed for ecclesiastical purposes. France and England both furnished early specimens of decorative ironwork.

The 13th century brought increased skill in the decoration of wrought iron. Hand chisels and files, used at first for the decorating, were soon abandoned for the quicker means of fashioning the metal by hammering it while it was hot. Working with the red-hot bars led to a spontaneity of composition. Beautiful scroll designs were combined with leaf forms, and separate details were welded to each other to give the design a unified series. As knowledge of the possibilities of the metal advanced, designs in wrought iron, done under the direction of the more skilled craftsmen, often were as delicate and airy as those of the finer and more precious metals. The fragile traceries and vines, tendrils and leaves achieved by these early craftsmen rivaled in their delicate handling the lightness of the original plants. In France, where the craft had long lain dormant, Louis XIV gave it a generous patronage. Brilliant specimens of the ironworker's art adorned almost every important French dwelling. Entrance gates, screens and balustrades, beautifully designed and painted in bright colors, made this the outstanding era of ornamental ironwork. The extreme popularity of ironwork in France revived the art in England, and during the reign of William and Mary, and later of Queen Anne, ornamental iron became very fashionable, achieving a richness of design unknown before.

Ornamental wrought iron in America has been important since early Colonial days. The colonists brought ironworkers and materials with them. The influence of Spanish and French craftsmen may be seen in much of the fine old ironwork in New Orleans. In the Colonial houses further north examples of English and early American work are more often found. The advent of cast-iron in the 19th century with its labor-saving devices caused the art of wrought iron to sink into desuetude. But no imitations, however skillfully produced by casting, have been artistically successful as a substitute. Consequently wrought iron is again steadily gaining in favor, and is being used more and more in the building arts.

See D. M. Driscoll, *Architectural Iron Design;* C. J. Foulkes, *Decorative Ironwork from the 11th to the 18th Centuries.*

IRON AGE, the stage of culture in which iron superseded bronze in implements and weapons. And, just as the period of polished stone weapons overlapped the BRONZE AGE, the Bronze Age overlapped the beginning of the Iron Age. In the *Iliad* and *Odyssey* of Homer the period of transition was recorded. There were swords and armor of bronze, but there were also iron swords, and a mass of iron was among the prizes in the games to celebrate the funeral of Patroclus. It has been suggested that by "dark blue iron" Homer meant steel. In the time of Hesiod, in the 9th century B.C., iron had superseded bronze, and Hesiod looked back to the Age of Bronze. It is probable that the new metal was first known from meteorites, many of which contain metallic iron. Knives made of meteoric iron are still used in the temples of Tibet.

The smelting of iron ores probably originated in Asia, by the use of a process like that known to the natives of East Africa, who reduce iron ore by using bellows made of inflated goat skins with a funnel of baked clay. Once discovered, the smelting of iron

made its way westward through Assyria, Egypt and Phoenicia to the countries of the Mediterranean and thence to northern and western Europe. Iron ores occur in nearly every country in Europe.

Hallstatt in the Noric Alps of the Austrian Tirol is the representative site for the Early Iron Age in central Europe. Salt mines were worked at Hallstatt from remote times. Cemeteries in which the salt miners of old time were buried have been excavated, and have yielded a large variety of weapons and implements. These show that here also the Bronze Age overlapped the Iron Age, as bronze and iron weapons and instruments are found side by side. The enameling of metal was also practiced, as in Egypt and Greece. A beautifully designed and enameled helmet found at Hallstatt is among the chief treasures in an Austrian museum. Ornaments found at Hallstatt show well-developed artistic taste.

The ancient settlement of La Tène, "the shallows," near the little town of Marin, at the northeastern end of the Lake of Neuchâtel, Switzerland, is in the same way the representative site for the second stage of the Early Iron Age. The ancient settlement was built on piles, like the earlier Neolithic lake dwellings. A vast number of weapons and implements of many kinds have been excavated at this site, and have been assigned to two periods, which have been dated as follows; Period II. 300-100 B.C.; and Period III. from 100 B.C. to the beginning of our era. Period I from 500-300 B.C. is not represented here. Among the many objects found at La Tène are: iron swords in iron scabbards, lance heads and arrow heads, sickles and scythes, axes, knives, chisels, rings, fibulae like ornate hat pins, sword hilts, lances, pikes, javelins, helmets, shields, and coats of mail. The presence of many small objects of bronze shows that bronze continued in use, especially for objects of adornment. Among the more ornamental objects found at La Tène are bracelets and torques, the latter being neck ornaments shaped somewhat like a stiff collar.

When Julius Caesar invaded Britain in 55 B.C. he found both bronze and iron in use among the Britons. He says that the Britons used rings of iron for money, showing that the metal was still comparatively rare. They also had iron tires on their chariot wheels and iron fittings on their chariots. Excavations in ancient tombs show that the warriors of the Iron Age in prehistoric Britain were armed with short, leaf-shaped iron swords for stabbing, modeled on the earlier bronze swords. At a later time, particularly in the north, they had longer swords without a point, for delivering a cutting blow. The handles of iron swords were fitted with a guard, which is not present in the short swords of bronze. Chariots, built of wood, had iron fittings, and the horses had trappings of bronze and iron on their harness, sometimes beautifully decorated with patterns in blue, red, yellow and green enamel.

It is worth noting that many Etruscan designs found their way into British art of the Early Iron Age, probably coming by way of Hallstatt; for example, the decoration on a splendid gold corselet found at Mold, in Flintshire, North Wales, and the gold cap found in Devil's Bit bog, Tipperary, Ireland. From a remote period Ireland supplied much gold, as illustrated by many artistic works in the Dublin museum. And, in general, the art of the prehistoric Iron Age in France, Germany and Switzerland was strongly influenced by Etruscan designs, which found their way as far north as the Baltic sea, meeting the trade in amber.

Iron was introduced into Scandinavia about the beginning of the Christian era, superseding the Bronze Age at a comparatively late date. The Iron Age in Norway and Sweden has been divided into three periods: Period I. up to the year 450, which shows many traces of Roman influence; Period II. from 450 to 700, when the styles of the Eastern Empire with its capital at Constantinople predominate; Period III. from 700 to 1000, leading up to the period of the Vikings. A boat with a high stern and 12 pairs of oars was found in a peat moss at Nydam, Schleswig, Denmark, in which were iron weapons and implements and also Roman coins belonging to the years from 67 A.D. to 217. This boat, built of oak planks, was 70 feet long by 9 feet broad, and is a prototype of the later Viking ships which plundered the coasts of Western Europe, and sailed as far as Greenland and even Labrador.

An interesting stage of transition between the Bronze Age and the Iron Age is illustrated by a socketed axe of bronze with a thin edge of iron let into it, found at Villanova, near Bologna, Italy. Bronze axes with iron edges are also found in Scandinavia. Bronze swords in Swiss lake dwellings sometimes have hilts inlaid with iron. This shows that when these weapons and implements were made, iron was scarcer and more highly prized than bronze. *See* ARCHAEOLOGY. C. J.

IRON AND STEEL INDUSTRY, UNITED STATES. This great industry, which in magnitude surpasses the iron and steel industry of any other country, has been a factor of supreme importance in the progress of the nation. Primarily the industry comprises the manufacture of crude iron and steel, but, in a more comprehensive sense, it embraces the manufacture of various iron and steel products, including machinery, transportation equipment for land, water and air, and also railway carshop construction and repair. In value the combined output of these groups amounts to more than one-fourth of the total manufactures of the United States.

As classified in the Census of Manufactures the statistics for the industry are presented in three groups, namely (1) Iron and Steel: blast furnaces (pig iron); (2) Iron and Steel: steel works and rolling mills; and (3) Iron and Steel: other iron and steel products, exclusive of machinery, transportation equipment and railway carshop construction, which are reported as separate industries. Statistics for the three groups, and a summary for these groups, are given in the following tables.

IRON AND STEEL: BLAST FURNACES

Year	No. Establishments	Wage Earners	Wages $	Value of Products $
1919	195	41,660	73,769,395	794,466,558
1923	169	36,712	58,935,384	1,007,613,340
1925	122	29,188	45,312,168	765,286,229
1927	116	27,958	44,258,499	708,904,236
1929	105	24,960	41,958,569	771,425,464

STEEL WORKS AND ROLLING MILLS

Year	No. Establishments	Wage Earners	Wages $	Value of Products $
1919	500	375,088	637,637,430	2,828,902,376
1923	489	388,201	637,825,137	3,154,324,671
1925	473	370,726	614,984,982	2,946,068,231
1927	486	361,312	601,275,499	2,779,840,238
1929	486	394,574	689,015,541	3,365,788,805

OTHER IRON AND STEEL PRODUCTS

Year	No. Establishments	Wage Earners	Wages $	Value of Products $
1921	5,627	317,585	376,827,000	1,554,957,000
1923	5,700	467,747	627,827,000	2,666,903,000
1925	5,473	451,356	624,042,000	2,748,773,000
1927	5,744	446,231	618,872,000	2,710,508,000
1929				

SUMMARY, IRON AND STEEL PRODUCTION

Year	No. Establishments	Wage Earners	Wages $	Value of Products $
1921	6,255	571,798	731,184,000	3,456,387,000
1923	6,358	892,660	1,324,587,000	6,828,841,000
1925	6,068	851,270	1,284,339,000	6,461,668,000
1927	6,346	835,501	1,264,406,000	6,199,252,000
1929				

IRON AND STEEL SHEETS. Sheets are a major item of finished iron and steel. Ease of forming, combined with strength and permanency, has resulted in a tremendous growth in their consumption. Automobiles, buildings, furniture, and containers of all kinds demand sheet steel. Canning requires an increasing production of tin plate (*see* TIN AND TERNE PLATE) or tin-coated sheet steel. Zinc-coated or galvanized sheets find a large use. Terne plate or roofing tin carries a lead-tin alloy coating on a sheet steel base. Vitreous enamel coatings are also being applied to iron and steel sheets in increasing volume.

The iron or steel for sheets is largely a mild or low carbon grade produced by either the open hearth (*see* OPEN-HEARTH STEEL), or Bessemer (*see* BESSEMER STEEL) process, although special requirements require special steels. The sheets are generally formed by hot rolling sheet bars or slabs delivered from the bar or blooming mills. Sheet bar is usually eight inches in width and approximately the same in length as the width of the finished sheet. The thickness or gauge of the finished sheet is governed by the thickness or weight of the bar. Slabs find use in the strip mills which may supplement or replace in part the conventional sheet mill.

In the conventional two-high non-reversing hot sheet mill the bars are "roughed down" by hand, matched in pairs, reheated, reduced further on a finishing mill, finally doubled, reheated and the rolling continued until the desired gauge is attained.

Continuous strip mills are used increasingly in the reduction or partial reduction of steel to sheets with the elimination of much hand labor. In the heavier gauges the hot reduction may be completed on the strip mill but with a lighter product the strip may serve as raw material for further reduction on hand finishing mills. Present developments in the cold reduction of steel may lead to less hot reduction and more cold forming of sheets and strip. Modern four-high and cluster cold mills are able to reduce fairly wide hot rolled strip to light gauges with satisfactory results. (*See also* ROLLING MILLS.)

After hot forming, the sheets are sheared and also opened if rolled in multiple. Subsequent treatment depends upon the finished product. The sheared and opened sheets may be softened by an annealing heat treatment (*see* HEAT TREATMENT) if a black or blue annealed product is desired or may be cleaned and pickled (*see* PICKLING OF METALS) before annealing for better surface.

Box annealing in piles may follow or single sheets may be annealed in a continuous or hand operated furnace. If the furnace raises the sheet temperature sufficiently high and the resultant product is fine-grained, the process is known as NORMALIZING. Such treatment is generally favored for a deep drawing product.

After heat treatment the sheets may be cleaned by pickling and then cold rolled on two or four-high mills under high roll pressure if a dense smooth surface is required. Cold rolling also stiffens and flattens the sheet. It may or may not be followed by another annealing, depending upon the degree of softness desired. After such an annealing certain sheets may be pickled again, especially those intended for tin plate. Blued sheets are produced by slight surface oxidation in air or steam. Finished steel sheets are often oiled to prevent rusting during transit and storage and less frequently painted for more complete protection.

Sheets rolled from special grades of steel are used for specific applications. Corrosion resistance is increased by the addition of copper. Very low metalloid steel or ingot iron is advantageous for certain purposes, especially vitreous enameling. High silicon sheets, by reducing electrical losses, have permitted the present development of the electrical industry. Chromium and chromium-nickel stainless steels (*see* CHROMIUM STEELS) are finding an increasing use in sheet form for bright metal or heat resistant purposes.

Corrugated Steel Sheets. Galvanized, black and painted steel sheets are often formed into suitable corrugated shapes for building and other construction, usually in the interest of increasing their strength and rigidity and also for ease in fabrication. Corrugated sheets are widely used for roofing and siding purposes. V-crimping; brick, stone and weatherboard siding; beaded ceiling; ridge roll and ridge angle or cap are all formed sheet designs used to a considerable extent in building construction. Sheets may also be seamed end to end as roll roofing. Corrugated sheets are often rolled into culverts. The

corrugations or grooves are generally formed by passing between corrugated rolls. The corrugations vary from a maximum width of about 5 to a minimum of about 5/8 in. with about 2½ ins. a widely used average. Corrugations may also be formed in a press. The other designs mentioned are generally pressed. *See also* GALVANIZED SHEETS. J. C. W.

IRON BLAST FURNACE is essentially a steel shell 90 ft. high and 25 ft. in diameter, lined with fire brick. It performs the daily task of converting from 1,800 to 2,500 tons of iron ore into 1,000 tons of pig iron. Iron ore, coke, and limestone are charged into the top of the furnace and descend counter-current to the reducing gases generated near the bottom of the furnace. Iron in the form of pig iron or steel is the foremost metal in modern life because of its high utility and comparative cheapness.

Iron ore contains moisture, gangue, and oxygen chemically combined with the iron. This chemically combined oxygen is removed in the blast furnace by bringing iron ore in contact with hot carbon monoxide gas, which will take oxygen away from ore. After the moisture and oxygen are removed in the upper part of the furnace the iron and gangue which remain are melted by the incandescent coke and trickle down to the lower part of the furnace.

The heat needed to melt the iron and slag and to bring the iron ore and carbon monoxide up to reacting temperatures is produced by forcing preheated air through water cooled openings called tuyères located near the bottom of the furnace. Upon entering the bed of incandescent coke in front of the tuyères, the oxygen in the air is converted to carbon monoxide, the inert nitrogen undergoing no change. The hot gaseous products of combustion, consisting of about 66% nitrogen and 34% carbon monoxide, ascend along a tortuous path formed by the openings between the lumps of coke in the lower quarter of the furnace and by the ore, coke, and limestone in the upper three-quarters of the furnace. The carbon monoxide gas takes oxygen from the iron ore and leaves the top of the furnace as carbon dioxide, while the inert nitrogen acts as a heat carrier. Upon reaching the lower part of the furnace the molten iron absorbs carbon, phosphorus, manganese and silicon. The gangue in the ore combines with the calcium oxide from the limestone to form liquid slag, which removes a part of the sulphur absorbed by the iron from the coke. The molten pig iron and slag which collect in separate layers below the tuyères are withdrawn at regular intervals. T. L. J.

IRON-CLAD OATH, the oath prescribed in the Act of July 2, 1862, for every person elected or appointed to any office, civil or military, of the United States Government, that such person had never voluntarily borne arms against the United States, nor given "aid, countenance, counsel, or encouragement to persons engaged in armed hostility thereto," nor "yielded a voluntary support to any pretended government, authority, power, or constitution within the United States hostile or inimical thereto." By the Act of Mar. 23, 1867 this oath was required in the ex-Confederate states, except Tennessee, of any applicant for registration as a voter. The oath was popularly called iron-clad because its careful wording precluded all persons who had given any countenance whatever to the Confederacy.

IRON MOUNTAIN, the county seat of Dickinson Co., Mich., in the western part of the Upper Peninsula, on the Menominee River, 72 mi. north of Menominee. It is served by three railroads and by bus lines. Iron Mountain is in the midst of a rich iron mining district, a large automobile company maintains a plant and sawmill here. In 1929 the local manufactures were valued at about $1,500,000; the retail trade amounted to $6,601,969. Iron Mountain was incorporated in 1879. Pop. 1920, 8,251; 1930, 11,652.

IRON RIVER, a city and summer resort in Iron Co., northwestern Michigan. It is situated near the Brule River, 83 mi. southwest of Calumet and is served by two railroads. The city is surrounded by productive iron mines and large tracts of timber. The chief local manufacture is butter. Farming is carried on in the vicinity and Iron River is the business center for most of Iron County. Iron River was founded in 1875 and became a city in 1926. Pop. 1920, 4,295; 1930, 4,665.

"IRONSIDES." *See* "CONSTITUTION."

IRONTON, a city on the southern boundary of Ohio, the county seat of Lawrence Co., on the Ohio River, 22 mi. southeast of Portsmouth. The city's transportation facilities include the Detroit, Toledo, and Ironton and the Norfolk and Western railroads, a bridge to Russell, Ky., ferry connection with the Chesapeake and Ohio railroads, and river craft handling a considerable commerce. In Ironton, foundries, rolling-mills, fire-brick and Portland cement works, and smaller manufactories had a total output of approximately $8,000,000 in 1929; the retail trade amounted to $7,237,563. Coal and iron mining and lumbering are the principal activities of the surrounding district, and rich deposits of fire-clay are found. Dean Forest comprises a 1,700-acre tract 11 mi. north of Ironton. Pop. 1920, 14,007; 1930, 16,621.

IRONWOOD, in the United States, the name given to various trees with heavy, close-grained, durable wood, especially to the blue beech (*Carpinus caroliniana*) and the hop-hornbeam (*Ostrya virginica*), of the eastern and southern states. The name is applied also to the southern buckthorn (*Bumelia lycioides*), the southern leatherwood (*Cyrilla racemiflora*), the red stopper (*Eugenia confusa*), the inkwood (*Exothea paniculata*) and the lignum vitæ (*Guajacum sanctum*), found in the Gulf states. The mesquite (*Prosopis juliflora*) and the tesota (*Olneya Tesota*), of the southwestern deserts, are also known as ironwood. The rare Catalina ironwood (*Lyonothamnus floribundus*) is found only in a few islands near the coast of southern California. In other parts of the world numerous hardwooded trees are called ironwood.

IRONWOOD, a city of Gogebic Co., Michigan, in the Upper Peninsula, situated on the Montreal River, opposite Hurley, Wis. It is served by bus lines and three railroads. The County Airport is 4 mi. distant. The principal industry of the vicinity is iron mining, although cattle raising, lumbering and farming are important. In 1929 local manufactures were valued approximately at $1,000,000; the retail trade amounted to $7,373,783. Ironwood was settled in 1884 and incorporated in 1889. Pop. 1920, 15,739; 1930, 14,299.

IRONY, stating the contrary of what is actually meant, but with something in the attitude or the words of the speaker to show that he does not seriously mean what he says. In argument or debate the statement is usually so palpably false that it shows argument along a certain line, even if it does not go to extremes, to be ridiculous, a famous example being Swift's suggestion that the food shortage and other evils incidental to over-population in Ireland could be remedied by having the children of the peasantry fattened for use at the table. Irony is used chiefly for purposes of ridicule or contempt, and is a powerful weapon of the satirist; but in a more detailed way it can also register one's appreciation of the incongruous. So-called Socratic irony is an affectation of ignorance and a thirst for information upon the part of a person already well-informed; at first this attitude seems sincere, and it is only by degrees that the hearer comes to realize that it is merely assumed. K. D. S.

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IROQUOIS, the confederacy of Iroquoian tribes first known as the Five Nations, comprising the Cayuga, Mohawk, Oneida, Onondaga and Seneca, and, after the admission of the Tuscarora in 1722, known as the Six Nations. They were also known collectively as the Maqua, Mohawk, Seneca and Tsonnontowan, from the names of their leading tribes. In historic times the Iroquois occupied most of western and northern New York, including the territory extending from the eastern watershed of Lake Champlain to the western watershed of the Genesee River and from the Adirondacks south to the territory of the Conestoga. They were the most important of the Eastern Woodland Indians. In their political strength of organization each chief maintained his own dignity and authority, but questions affecting the entire group were decided by a general council in which each tribe had a fixed number of seats. Available evidence indicates that the Five Nations had its beginnings in 1570, following wars with Huron and Algonquin tribes, and according to tradition it was formed at the instigation of Hiawatha, a Mohawk, and Dekanawida, reputed to have been a Huron by birth. The Iroquois were intensive agriculturists, depending on maize, beans and squash raised by the women. Hunting and warfare were the primary occupations of the men. Their bark-covered wigwams were rectangular in shape with gabled roofs and were substantially built. Permanent villages frequently had wooden stockades. They were skilled makers of bone implements, pottery and basketware, which are highly characteristic and easily distinguished from those of neighboring tribes. The entire tribe was separated into two halves or "moieties." Membership in one or the other determined the side taken in athletic contests and all important ceremonials. These two divisions were in turn divided into clans of maternal descent. Individuals were forced to marry out of their own clan. Tribal festivals periodically celebrated the berrying season, the sowing and harvesting of maize and the like. Secret or false face societies, of which 12 are known, were devoted to curing disease through the use of masks representing supernatural beings whose power was supposedly transmitted to the wearer. The economic and social culture of the Iroquois was more complex than that of the Algonquin and other typically Eastern Woodland tribes. Some authorities claim that they came from north of the St. Lawrence, though certain factors such as maternal descent, the use of the blowgun, the intensive practice of agriculture and other ethnological traits are strong indications of a southern origin.



GEORGE CATLIN, NORTH AMERICAN INDIANS

RED JACKET, A SENECA INDIAN

IROQUOIS-FRENCH WARS. In 1609 SAMUEL DE CHAMPLAIN accompanied an expedition of Algonquin and Huron Indians against the Iroquois, doubtless because hesitation to ally himself with the Indians of Canada would have hazarded the fortunes of the fur trade. At Ticonderoga on July 30 the guns of the French party put the Iroquois, hitherto unacquainted with firearms, to rout. There began hostility of the Iroquois toward the French in Canada which was practically without intermission until 1701. Jesuit missionaries and *coureurs de bois,* alone or in small parties in the wilderness, especially suffered; the settlements on the St. Lawrence were several times menaced. The original motive of revenge was quickly superseded by an economic motive. The Lake Nipissing-Ottawa River route, whereby furs from the Northwest were brought to the St. Lawrence, was controlled by the Algonquins. The Iroquois, in control of the Great Lakes route and acting as middlemen for the Dutch traders at Ft. Orange (later Albany) determined to secure a monopoly of the traffic and developed a policy of annihilation of all tribes that blocked the monopoly. The Algonquins, Hurons, Petuns and Neutrals were

eradicated or dispersed by the Iroquois; and the French, as allies of these tribes, suffered. The torture and massacre of missionaries were incidents in the execution of a trade policy which by 1650 practically choked the fur trade of New France. In 1660 an expedition of the Iroquois nations in concert against Montreal was barely thwarted.

Louis de Frontenac alone of the governors of New France in the 17th century succeeded in checking the Iroquois attack, and after 1696 kept the Indians on the defensive. Taking advantage of the alarm of the Iroquois at the formal claims of sovereignty over them advanced by the British, the French opened negotiations, and signed a definitive treaty of peace with the Iroquois at Montreal, Aug. 4, 1701. Thereafter the clever policy of the Iroquois was to fraternize with the French and trade with the British.

IROQUOIS TRAIL, a famous Indian thoroughfare from the Hudson River to the Niagara. The route followed the Mohawk valley, and near the present Rome, N.Y., struck the watershed between the St. Lawrence and the southerly systems. The watershed was followed for 200 miles, to the Niagara River just south of the falls. It passed successively through the territory of the Oneida, Onondaga, Cayuga and Seneca nations of the Iroquois Confederacy, in each domain, except the Seneca, striking the capital town.

IRRADIATED FOODS. In 1924 it was shown by Hess and by Steenbock that various inert foods, when subjected to ultraviolet rays (*see* Ultraviolet Radiations) acquired specific nutritional properties. Such foods, for example, olive oil or cottonseed oil (*see* Oils as Food Products), flour, etc., become endowed with vitamin D (the antirachitic vitamin) and may be used to protect against or to cure Rickets in infants, in the same way that cod liver oil, sunlight, and ultraviolet irradiation are employed for this purpose. This remarkable change in the foods is due to a photochemical alteration in the ergosterol, a fatty substance which has recently been realized as being present in almost every animal and vegetable cell. This discovery has been put to practical dietetic use, and irradiated dried and fluid milk, irradiated Yeast, or bread prepared with irradiated yeast have been placed on the market. The same physiologic effect can be brought about in foods in lesser degree by means of the sun's rays. When activated foods of this kind are fed to nursing women or to milch cows they convey valuable rickets-protective or curative properties to the milk, so that this indirect method has been recommended to protect infants from this most widespread nutritional disorder. *See also* Vitamins in Foods; Foodstuffs; Light, Artificial, in Treatment of Disease. A. F. H.

IRRATIONAL NUMBERS, real numbers that cannot be expressed in the form of a proper fraction of the type p/q, where p and q are both real and rational numbers. As an example of an irrational number the length of the diagonal of a square of side 1 may be taken. The diagonal is then equal to $\sqrt{2}$, and it cannot be expressed by any decimal or terminating fraction. The modern theory of irrational numbers was developed by Dedekind. In the case of $\sqrt{2}$ we can show that

$$\sqrt{2} = 1.41421\ldots = 1 + \cfrac{1}{2 + \cfrac{1}{2 + \cfrac{1}{2 + \ldots}}}$$

neither of the operations terminating, although each of the expressions is equal to a finite number. *See* Fractions; Continued Fractions; Decimals.

IRRAWADDY, a river of India, rising in eastern Tibet, traversing lower and upper Burma and falling into the Indian Ocean by various mouths after a course of 1,200 mi. From time immemorial the principal highway of Burma has been the Irrawaddy, navigable from its eastern mouth, the Rangoon River, to Bhamo, a distance of 900 mi. A constant stream of boats of all sizes, from steamers 300 ft. long to the characteristic native junk, ply to and fro; many steamers are traveling bazaars, and at each landing stage considerable exchange trade is done. Huge rafts of timber float downstream to sawmills at Rangoon, on the tidal estuary. Teak is dragged by elephants and floated down the tributaries to the main stream.

In the wet season the river rises from 35 to 40 ft. at Prome, 200 mi. from the sea, and the river is liable to overflow its banks as far inland as Katha, 150 mi. from Mandalay. Rice is cultivated everywhere; on the flooded land upstream for home consumption, at the head of the delta for export. The houses are built on piles, but in some districts the people take to the hills in the flood season. The lower part of the Irrawaddy delta is swamp and jungle, and uninhabited. By embanking the left bank of the river it is hoped to win ultimately 500,000 acres for rice cultivation.

IRREDENTISM. *See* Risorgimento, The.

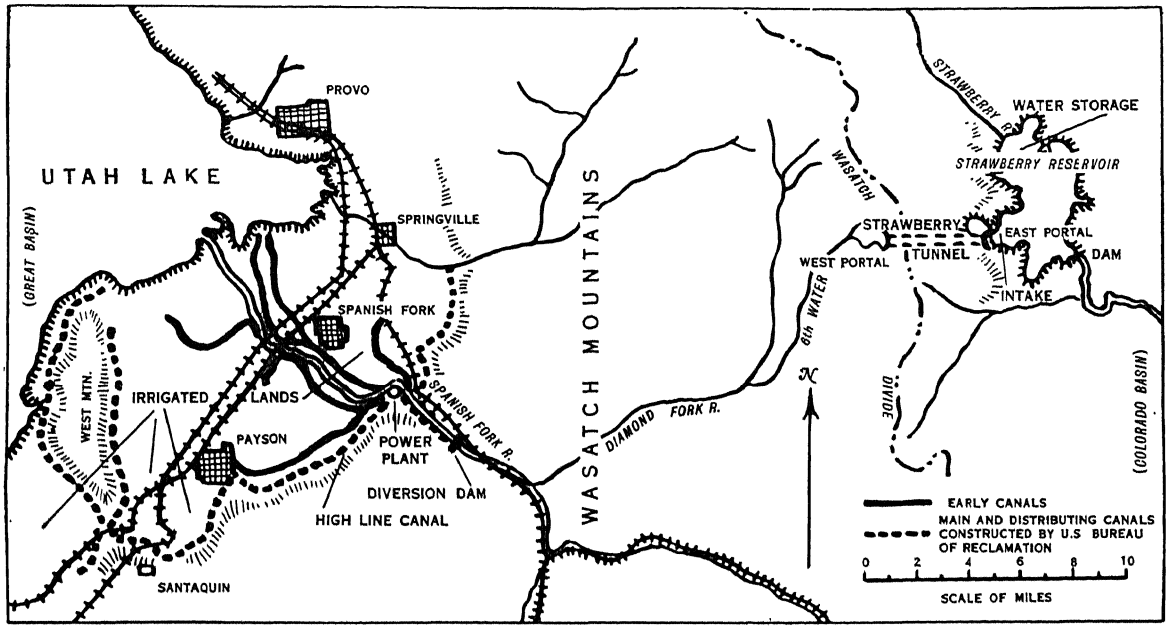
IRRIGATION, the supplying of water to crop land by artificial waterways which carry the water from a lake, river or other source, thus furnishing moisture to otherwise arid territory. Irrigation has been practiced for centuries, dams, weirs and other works for storing water having existed in Egypt as early as 2000 B.C. In Babylonia and Assyria, Persia and India, vast systems of irrigation canals were dug during the dawn of history, and also at a very early date in what is now New Mexico and Arizona.

Irrigation has always been necessary in these regions because of the lack of rainfall. Precipitation of less than 20 in. annually is generally considered deficient for the growing of practically any crops, and the populated area of the world on which less than 20 in. of rain falls annually is large. There are also large surfaces where the rainfall, though more than this, is very irregular, and under such conditions, irrigation is profitable. It is also practiced in countries with ordinarily sufficient rainfall in connection

with certain crops which require extreme moisture to mature. Thus in Louisiana, Arkansas, Mississippi and Texas there are a million acres on which rice is grown under irrigation, although the rainfall is 40 to 50 in. annually.

India has the greatest amount of land under irrigation, 40,000,000 acres being watered thus. In Egypt out of a total of 240,000,000 acres, about 6,000,000 are under irrigation and it is estimated that only about 7,500,000 additional acres can be reclaimed. Most of the irrigated territory of Europe lies in the south. The artificial watering of crop land was first practiced by the Romans, and the most extensive irrigation works are those in Italy, supplying 4,700,000 acres. The irrigation works of the plains of Piedmont in

There are two chief systems of irrigation, the basin and the perennial. The basin system is used chiefly in Egypt, where there are basins extending over 50,000 acres. Here land to be flooded is enclosed by earthen embankments and water is allowed to run in to a depth of from 3 to 5 ft.; later it is drawn off and the crops are sown. Under the perennial system, main canals lead from the source of supply. From these, smaller canals bring the water to the field limits, where they divide into tiny branches running parallel across the field, often but a few feet apart. Water flows through these all during the growing season and in many cases the year around. Under the basin system one crop a year is harvested, but under the perennial at least two and often three are grown.



MAIN FEATURES OF THE STRAWBERRY VALLEY IRRIGATION PROJECT, UTAH

Lombardy are very highly developed and the engineering is of a high class. In Spain, 2,800,000 acres are under irrigation, and in France about 400,000.

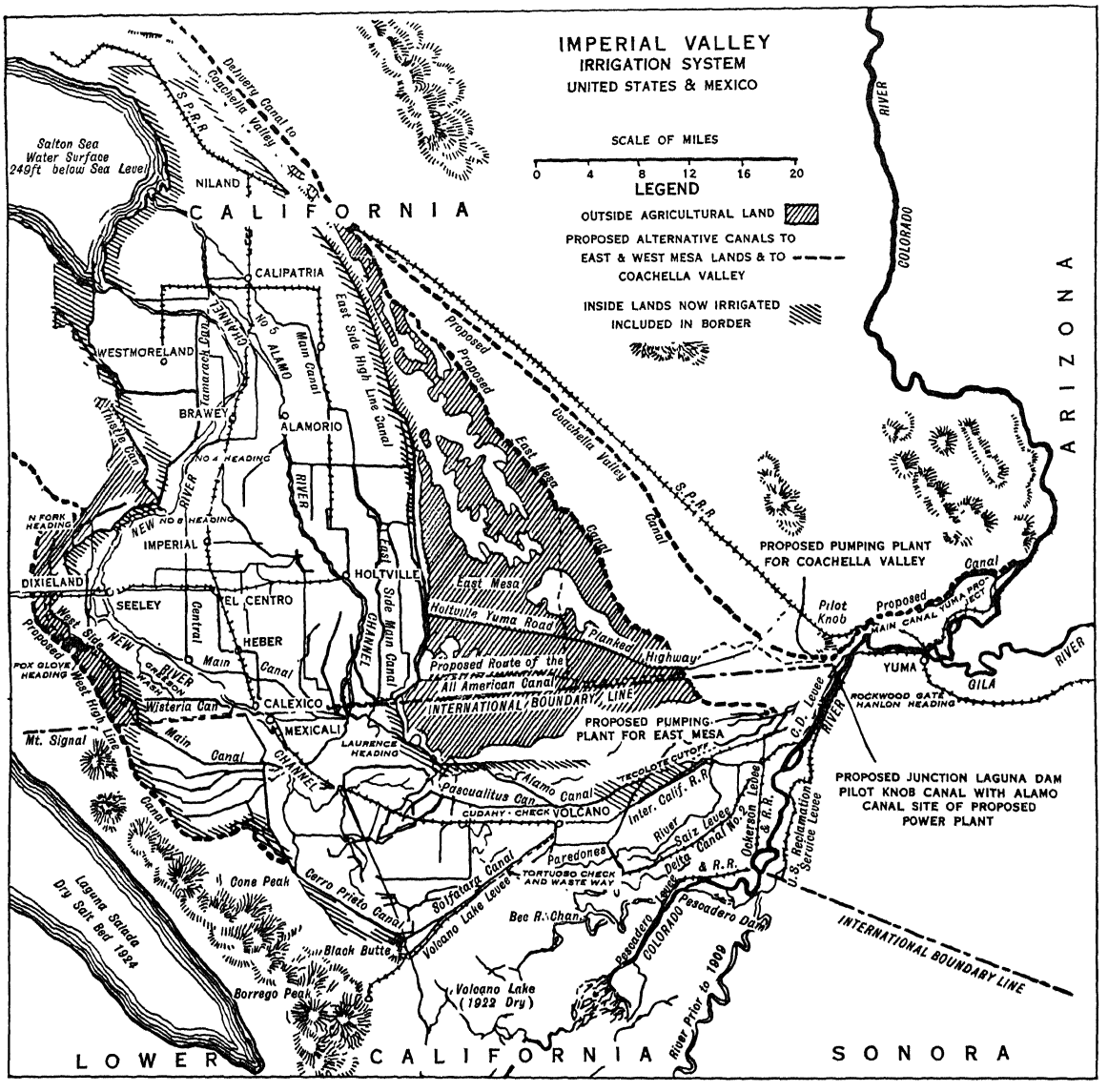
Water for irrigation comes from natural streams, wells and storage basins. In the United States, at least 90% comes from streams and this percentage probably obtains all over the world. In most streams the amount of water varies greatly with the season and it is therefore necessary to build dams with more or less elaborate arrangements for shutting off surplus water and so accumulating a reserve available when the natural flow abates. It is also necessary to arrange outlets for excess water, especially that due to sudden storms. Only a small amount of water used in irrigation comes from wells; the best examples of this character are in Australia. In India are many so-called irrigation tanks, small reservoirs usually with earthen walls often built at some distance from streams and used to store up water against the dry season.

Canals are usually the most expensive part of irrigation systems. Often extending many miles, in some cases they are built over hills or across the natural drainage of the ground, which may involve the construction of timber, metal or concrete flumes or pipes, as well as siphons. In ordinary canals dug in soil much water is lost, and in many cases these must be lined with a coating of concrete or puddled clay. The simplest form of the irrigation canal is the ditch, and to-day many of these are large enough to carry small boats, in India and Italy especially canals often being used for both irrigation and navigation. Flumes may be built of wood or steel, and may be rectangular or half round. The gates used in long or short canals to shut off the supply of water were formerly usually of wood but now are more often steel.

In many countries canals leading from the source of supply are lower than the land to be irrigated, and water must be pumped or otherwise lifted from the feeder canal to branches flowing through crop land. In

Egypt the mechanisms used for this purpose are both ancient and interesting. Chief of these is the apparatus called the *shaddof,* in India called *denkli.* It consists of two upright poles with a crossbeam joining them at a point 8 or 10 ft. above the ground. At right angles to this crossbeam is fastened a long pole, the slender end of which, projecting over the canal, usually has a leather bucket attached to it. This is balanced on the thick end by a mass of clay. The apparatus much resembles the old-fashioned well-sweep, still seen occasionally in this country. By means of it buckets of water are raised from the canal and poured into the ditch feeding the irrigated field. A more complicated device of eastern countries is the water wheel or sakia. Here one or two oxen walking in a circle turn a beam which makes a wheel revolve, lifting up an endless rope with a number of buckets attached to it.

In most parts of the world, because of the great expense, irrigation works are built by the government, payment being either by a tax on the crops raised on land thus irrigated, as in India and Egypt, or by payments for water used, as in the western United States.



AREAS UNDER IRRIGATION IN THE IMPERIAL VALLEY, UNITED STATES AND MEXICO AND PROPOSED ALTERNATIVE CANALS

Since flowing streams are public property, supplying drinking water and power and supporting navigation, laws must be devised to protect general rights when irrigation taps their flow. In the West, laws differ according to the locality and often questions as to the division of water have arisen between various interests. Six or more states for instance had to adjudicate the rights involved by the building of the Hoover Dam on the Colorado River.

Seventy per cent of the irrigation works of the country have been built by private individuals or by combinations of small groups. Corporations organized to build larger works than can be constructed by individuals account for 10% of the total, and the U.S. Bureau of Reclamation and the U.S. Indian Service for the remainder. In 1929 there were 74,863 enterprises actually irrigating 19,578,441 acres but capable of irrigating 26,087,891. When projects planned by these existing companies are completed they can take care of 30,800,015 acres.

The five states having the largest irrigated acreage are as follows: California, 4,746,632 acres; Colorado, 3,393,619; Idaho, 2,181,250; Montana, 1,594,912; Utah, 1,324,125. The largest irrigation dams in the United States include the following: Elephant Butte, on the Rio Grande, New Mexico and Texas, 306 ft. high, capacity, 860,000 million gals, cost $4,200,000; Roosevelt, on the Salt River, Arizona, 280 ft. high, 533,515 million gals., $3,900,000; Coolidge, Gila River, Arizona, 250 ft., 391,021 million gals., $5,500,000. The Assuan Dam on the Nile impounds 1,322,955 million gals., the greatest amount of water of any dam in the world. A. R. F.

AMERICAN IRRIGATION METHODS

Surface Irrigation. Before water can be efficiently or economically applied by any method to moisten dry soil, the surface of the field must be properly prepared and the necessary facilities provided. At least eight more or less distinct methods of surface irrigation have been evolved, and one or more of these is practiced in each irrigated section of the United States.

The furrow system is used to irrigate crops planted in rows, and consists essentially of a head ditch or pipe through which water is distributed to the heads of furrows, spaced from three to five ft. apart. A field to be irrigated by the border method is divided into strips 30 to 50 ft. wide by earthen dikes or borders, and a sheet of water diverted from the head ditch is allowed to run from top to bottom of each strip. The flooding method commonly practiced in the Rocky Mountain States, consists of directing water through a series of field laterals spaced 100 to 200 ft. apart, the soil in the intermediate spaces being irrigated by openings in the laterals.

In spray irrigation, a supply of water is put on the land in the form of fine drops. It is applicable to all kinds of soils, regardless of ground slope. It can be applied only through pipes and under pressure. The system most commonly used in the United States consists of parallel lines of pipe about 50 ft. apart and supported on rows of posts about 6½ ft. high, each line being equipped with small nozzles spaced 3 or 4 ft. apart. The water is pumped to these lines through underground pipes. Portable systems have been developed, using flexible pipe or hose. Spray irrigation systems are quite expensive and their use is generally limited to areas producing high-priced crops.

Other types of surface irrigation include the check method used in rice irrigation, the basin method in orchard irrigation, the corrugation method, a modification of the furrow method, and the surface-pipe method. A. T. M.; L. A. J.

Sub-Irrigation is a method of irrigation in which, by adding water through small ditches or tile drains placed from 20 to 30 ft. apart, the groundwater is brought to an elevation where capillary action will bring moisture to the surface. It is practicable only where the land to be irrigated is underlain by an impervious strata, preferably from two to four ft. beneath the surface, or where the water table is near the surface. The subsoil conditions which make sub-irrigation practicable are not common. When alkali is present in the soil in appreciable amounts the method is not to be recommended. S. H. M.

Water Conduits comprise the principal element and cost of most irrigation systems. In early times earth channels alone were employed. They still predominate, being improved by concrete linings and assisted by pipes and flumes of wood, steel or concrete. Linings are used to reduce seepage losses and increase capacity while pressure pipes are employed to convey water from pumps to higher lands and across depressions. Flumes span depressions and skirt along the sides of precipitous canyons.

Conduit capacity is generally computed from the formulae, $Q = AV$, and $V = C\sqrt{RS}$, where Q is the quantity in cubic ft. per second, A the area of the water section, V is velocity in ft. per second, R the hydraulic radius (the ratio of area of water section to the wetted perimeter), S the channel slope and C a complex term including the coefficient of roughness N, now well established for many surfaces by research. Approximate relative capacities, dependent on n are 100 for good concrete, steel and planed lumber; 80 for rough concrete, 60 to 40 for earth channels, good to bad condition, and 40 for rock cuts and tunnels. F. C. S.

Delivering Water on western irrigation projects includes continuous delivery of small streams to all irrigators; rotation or intermittent delivery of larger streams; delivery upon demand. Continuous delivery is advantageous under some conditions, but rotation is generally preferable. Demand delivery is not always practicable; where feasible, it is the most satisfactory method. Irrigation water is delivered by ditch-tenders under the direction of a superintendent. The average cost of delivery in 1922 on 61 representative projects was $102.86 per mile of canal operated; on 26 projects delivering to individual farms, $0.86 per acre irrigated. W. A. H.

Pumping. Irrigation water must often be pumped (*see* PUMPS) to lands higher than the water supply. To accomplish this, suction lifts may be used where the height does not exceed 20 ft. Deep-well plunger pumps are employed where small irrigation supplies are to be lifted more than 400 ft. but where large supplies are required rotary pumps are generally used. Rotary pumps include horizontal centrifugal pumps

which are efficient for lifts up to 50 ft.; vertical centrifugal pumps, which are best for lifts of 50 to 75 ft.; multiple turbines, set in "bowls," one above another, which are necessary for lifts of several hundred feet; and screw pumps which are efficient for raising large volumes of water a few feet. Where the water is taken from crooked wells, air-lift pumps are widely used; where running streams are at hand, current wheels are the rule, the stream supplying both the water and the power for lifting it. F. C. S.

Drainage of Irrigated Lands requires that drains, either open or tile ditches, be deep enough that capillary action will not bring water to the surface to evaporate and deposit alkalies injurious to plant life. Sub-surface conditions determine the location of drains; where water-bearing strata occur, drains should be located to intercept them. The size of drains is chiefly dependent upon their fall, upon the precipitation and the amount of irrigation water applied and upon the character of the soil; it is usually much less than provided for humid lands. *See also* IRRIGATION DISTRICTS; SEWAGE IRRIGATION; TILE DRAIN. S. H. M.

BIBLIOGRAPHY.—J. A. Widtsoe, *Principle of Irrigation Practice;* S. Fortier, *The Use of Water in Irrigation.*

Garden Irrigation. In arid and semi-arid regions garden irrigation differs only in degree, not in kind, from that of field crops. In so called humid districts, however, with 30 to 40 in. of annual rainfall, the distribution is often so uneven that droughts of a month or more occur during summer and plants often suffer or die for lack of water.

Special methods of irrigation have therefore been developed to insure success in spite of dry weather. Instead of wholesale distribution by means of open ditches the water is retailed by means of pipes. On truck and berry fields these are generally placed about 50 ft. apart and elevated on posts to avoid inconveniencing workers. For small gardens many devices are available, some to throw the water in only one general direction, others in two directions or in circles; some are stationary, others portable on runners or wheels. The water is under pressure and tiny streams of it break into minute drops, making it possible for each nozzle to supply a considerable area with a mist-like rain that seeps into the soil usually without puddling or crusting the surface. When it is thought to have penetrated to a foot or more it is shut off until the plants indicate that they are beginning to suffer. Then the ground is again soaked.

IRRIGATION BY SEWAGE. *See* SEWAGE IRRIGATION.

IRRIGATION DISTRICTS, public, quasi-municipal corporations, with defined geographical boundaries, authorized by law in 17 western states. Their purpose is to provide and distribute irrigation water to included lands. Their organization requires consent of part of the landowners and, in some states, an investigation by the state engineer. Management is entrusted to an elected board of directors.

Purchase or construction of irrigation works is usually financed by sales of bonds. The United States, through the Bureau of Reclamation, has financed much construction work under contract with districts; several states, notably Washington, Oregon and Wyoming, have similarly advanced funds secured by district bonds or contracts. District obligations are payable from proceeds of assessments which are levied and become liens against all benefited lands.

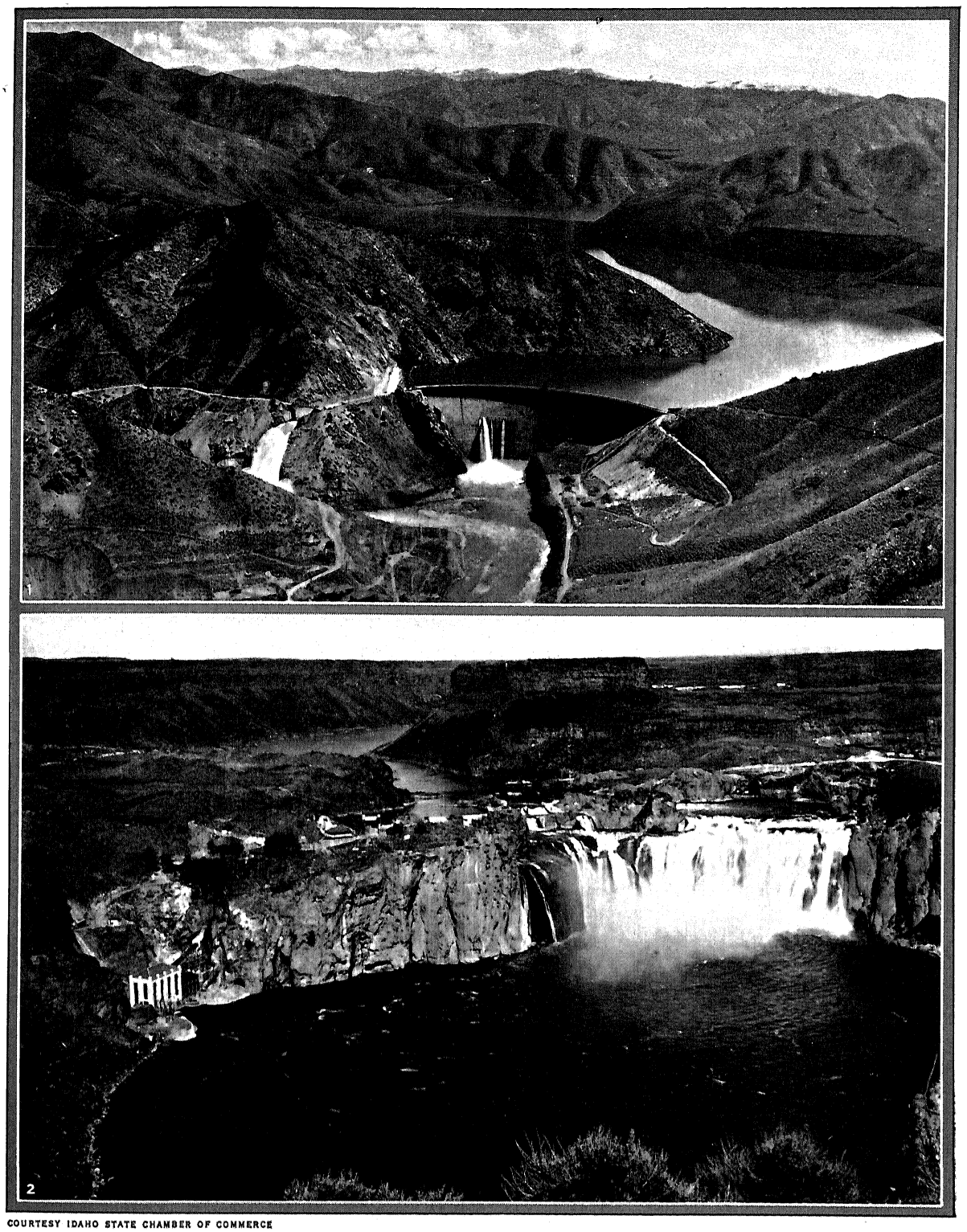
Irrigation districts, on the whole, have proved better adapted to improvement and enlargement of existing communities than to entirely new irrigation development. Statistics at the end of 1928 were as follows: districts organized 801, active 499, acreage in active districts 10,311,098; approximate acreage irrigated by district-operated systems 4,060,600. Bonds sold $224,843,197, bonds outstanding $185,026,159, averaging $24 per acre bonded. Seventy-one per cent of the bonds sold were then in good standing, but substantial defaults have since developed. *See also* IRRIGATION. W. A. H.

IRUÑA. *See* PAMPLONA.

IRVING, SIR HENRY (1838-1905), English actor whose real name was John Brodribb, was born in Somerset, England, Feb. 6, 1838. He left school early and became a clerk. His first stage appearance was as Gaston in *Richelieu.* After playing a wide variety of parts in provincial companies, he won a London engagement to play Doricourt in *The Belle's Stratagem.* In 1867 he joined the Queen's Theatre Company. His first great success was as Digby Grant in *The Two Roses,* 1870. The next year he began an engagement at the then moribund Lyceum Theatre, and with *The Bells* began a series of highly successful plays, *Charles I, Eugene Aram, Richelieu, Hamlet,* etc. Irving had an unusual personality, with strong mannerisms and some physical disabilities which caused much controversy. But he was a genius in psychological acting, and this comparatively new element in the theater gradually won over all opposition. He rose to be the dominant figure of the British stage, and in 1895 became the first actor-knight. His Shakespearean revivals, with ELLEN TERRY, set a new mark in brilliant staging. He made several successful visits to America. Irving died on tour at Bradford, England, Oct. 13, 1905, and was buried in Westminster Abbey.

BIBLIOGRAPHY.—G. Craig, *Henry Irving,* 1930.

IRVING, WASHINGTON (1783-1859), American writer, was born in New York City, Apr. 3, 1783. He was of English immigrant stock, his father a prosperous cutlery merchant who gave his sons every advantage of education and travel. Irving was intended for the law, but showed little liking for it. He turned to writing, using the essays of the *Spectator* as his model, and in 1807 and 1808, with his brother and a friend, he issued the *Salmagundi Papers.* (*See* SALMAGUNDI.) He had traveled through France, Italy, Holland and England, and returned with a cosmopolitan's eye to detect the pomposity and jingoism which were beginning to creep into American accounts of national affairs, and to write *Diedrich Knickerbocker's*



COURTESY IDAHO STATE CHAMBER OF COMMERCE

IRRIGATION PROJECTS IN IDAHO

1. Arrowrock Irrigation Dam, Boise River; completed 1915; cost, over $4,325,000; capacity, 91,200,000,000 gals.; height, 349 ft.; government owned. **2.** Shoshone Falls, Snake River. These falls are 215 ft. high, 52 ft. higher than Niagara. A hydroelectric power plant is shown at the extreme left-hand side of the photograph.

History of New York as a corrective. The book, published in 1809, though by no means unanimously acclaimed, was a genuinely comic parody of the contemporary historical tone and its satirical cleverness showed its young writer was admittedly a man to reckon with. In 1815 Irving returned to England. In 1818 his father failed, and Irving settled to writing in earnest, producing the *Sketch Book,* a collection mainly of articles which he had contributed to the *Analectic Magazine;* it included "Westminster Abbey," "The Legend of Sleepy Hollow," RIP VAN WINKLE, "The Spectre Bridegroom" and "The Pine-Tree Shillings." The book was almost equally his tribute



"SUNNYSIDE," WASHINGTON IRVING'S HOME AT IRVINGTON, N. Y.

to Europe and his immortalizing of the Hudson Valley countryside. Many of the sketches hover on the verge of being true short stories, and so constitute a literary landmark of first importance. *Bracebridge Hall,* 1822, turns again to England and the English Christmas for its material, and *Tales of a Traveller,* 1824, is a German Sketch Book. Once more Irving went abroad, living for some time in Madrid, where he published *A History of the Life and Voyages of Christopher Columbus,* 1828, the first of his biographies, and, in 1832, *The Alhambra,* second only to the *Sketch Book* in enduring popularity. After 17 years in Europe, he returned home and built himself a manor after his own heart overlooking the Hudson River. He wrote indefatigably, laboring for years on a *Life of Washington* which he finished just before his death, Nov. 28, 1859.

Irving's work was a point of great pride to his countrymen. It had a suavity and polish unlike anything the young country had previously shown. Irving had modeled himself accurately and successfully on JOSEPH ADDISON and RICHARD STEELE, but his use of local legends as material, and the fictional form to which his sketches pointed, have been of inestimable influence in American letters. *See also* AMERICAN LITERATURE.

BIBLIOGRAPHY.—C. D. Warner, *Washington Irving,* 1881; P. M. Irving, *The Life and Letters of Washington Irving, by his nephew,* revised ed. 1883; G. S. Hellman, *Washington Irving,* 1925.

IRVINGTON, a rapidly growing industrial and residential town of Essex Co., N.J., located 12 mi. west of New York City and adjoining Newark and East Orange. Its transportation facilities include the Lehigh Valley and Rahway Valley railroads, trolley and motor bus lines. It is a popular suburb of Newark and New York City and has a number of important industries, the products of which were valued approximately at $39,700,000 in 1929, and included the manufacture of chemicals, razor blades, refined metals, and iron and steel products. It is also an important jobbing and warehousing center. In 1929 the retail trade amounted to $20,430,821. Settled in 1692 and originally called Camptown, Irvington was incorporated as a village in 1835. In 1852 the name was changed to Irvington in honor of WASHINGTON IRVING. It received its charter as a town in 1898. Pop. 1920, 25,480; 1930, 56,733.

ISAAC, a Hebrew patriarch, son of ABRAHAM and SARAH, and father of JACOB and ESAU, derives his name from a Hebrew word meaning "the laughter." Sarah laughed when told she was to bear a child in her old age. Abraham laughed in surprise, and when Isaac was born, his mother said, "God hath made me to laugh; every one that heareth will laugh with me." Those modern scholars who accept the theory that the patriarchs are really clan personifications, see in this laughter, fragments of legends concerning an early tribal deity, "the smiling god of the clear sunny day." Other students hold that Isaac was a Jerahmeelite hero, part of whose cult was adopted by the Israelites who frequented his sanctuary at Beersheba. For most men, Isaac remains very real, the center of the dramatic story illustrating the substitution of animal for human sacrifice. The story of his love-making with Rebekah remains one of the Old Testament idyls. And the picture of the mingled greatness and weakness in Isaac as an old man, almost blind, still fond of good food and capable of blessing and cursing his two sons, has become a classic.

ISAACS, JORGE (1837-95), one of the foremost Romantic novelists of the Spanish-American republics, was born in 1837 at Cali, State of El Cauca, Colombia, the eldest son of an English Jew. His mother was a Catholic, Spanish and perhaps Catalonian. Isaac's heritage thus assumes a quadruple aspect. In his poems the English provenance of his father is attested by several versions from the English. The Jewish element appears in biblical reminiscences and in the novelist's melancholy. Spanish is his tongue; and Spanish-American, decidedly, is the milieu of the poems and novels alike.

The early youth of Isaacs was spent in the valley of the Cauca, and here he absorbed a deep and abiding love of nature. For some 5 years he attended a boarding school in the national capital, Bogota, after which he made a voyage to London. The death of both his parents occurred shortly after his return from abroad. The War of El Cauca, lasting from 1860 to 1863, wiped out the home and the property of the Isaacses and the members of the family were scattered. Jorge went to Bogota, where his book of poems appeared in 1864, winning the ear of the literary *élite.* To-day this work seems innocent enough, with its emphasis

on nature and animal pets, its love poems and recollections of war experiences. Had it not been for the continental fame that became his upon the publication, in 1867, of the idyllic novel, *Maria,* the poems in all likelihood would not now be known. As a result of the novel, Isaacs was promoted to a diplomatic post in Chile. His later career became a succession of such minor posts and of minor literary productions. Toward the end of his life he went into business and duplicated the failure of his father. He dragged out a poverty-stricken existence until 1895.

Maria has been called the best novel that has come out of South America. It belongs to the school of *Paul and Virginia,* but it has a sound core of reality, having been born of the author's passional life and placed in his native surroundings. It is a simple and affecting tale of young love doomed to frustration; Maria, the heroine, dies before her Efrain, away in London, can return to her side. The hurried journey back, after Efrain has been notified of Maria's critical condition is a masterpiece of narrative suspense. The novel, translated into many tongues, seems destined to resist changes in style and in taste. I. G.

ISABELLA (La Catolica) (1451-1504), Queen of Castile, was born at Madrigal, Apr. 22, 1451. The daughter of John II of Castile, she had numerous suitors but was finally married to Ferdinand of Aragon, Oct. 19, 1469. On the death of her brother, Henry IV, Isabella succeeded to the throne of Castile and Leon ignoring the claims of Joanna, Henry's daughter. Castile and Aragon were united and Ferdinand and Isabella assumed the title of King and Queen of Spain. Isabella was an intelligent woman and made a conscientious attempt to rule ably but her intensely religious nature and the influence of her confessor, Juan de Torquemada led her to encourage the SPANISH INQUISITION and the persecution of the Jews. She was one of the chief supporters of Columbus, offering even to pawn her jewels to obtain funds for his expedition. Isabella died at Medina del Campo, Nov. 26, 1504.

ISABELLA II (1830-1904), Queen of Spain, was born at Madrid on Oct. 10, 1830. She succeeded her father, FERDINAND II, in 1833, the Salic law having been set aside by the Cortes in 1830. She attained her majority in 1843, after civil difficulties during the period of regency. In 1846 she married Don Francisco d'Assisi. Her reign was distinguished by a multitude of intrigues and by several insurrections. As a result of the revolution of 1868, Isabella was exiled. In 1870 in Paris she abdicated in favor of her son, Alfonso XII. She remained in France until her death on Apr. 10, 1904.

ISAIAH, BOOK OF, the first and greatest of the major prophetical books of the Old Testament, derives its name from a prophet who preached in the 8th century B.C., c. 740-01, an opponent of the policy of alliances with foreign powers. Renan said of him, "Semitic speech reaches in him its highest combinations." We know practically nothing of the life of Isaiah and the book ascribed to him is by many modern scholars now ascribed to at least two or three others. Parts are even attributed to a date as late as the 2nd century B.C. Chapters 1 to 39 are written by an Isaiah facing the invasion of the Assyrians, while chapters 40 to 66 reflect a post-exilic period, opening with the significant words, "Comfort ye, comfort ye, my people."

The book has played a prominent part in the history of Christian doctrine and experience, chiefly on account of its apparent Messianic passages. These have won for the author of the post-exilic chapters, the name of "the evangelical prophet." The imagery and vivid language as typified by Chapter 53, setting forth the sufferings of "the servant of God," account for this interpretation. It was almost inevitable that Christians should feel that the phrase "a man of sorrows and acquainted with grief" could refer only to Jesus. Some of the noblest passages in the Bible are in this book. Isaiah stands before one small nation uttering universal truth, and when he says, "Thou wilt keep him in perfect peace, whose mind is stayed on Thee," he speaks comfort to all nations. When he cries, "The everlasting God, the Lord, the Creator of the ends of the earth, fainteth not, neither is weary; there is no searching of his understanding," he utters words which yet thrill and comfort the race.

ISERLOHN, an industrial city in the Prussian province of Westphalia, located on the Baar River west of Arnsburg. It manufactures principally iron, brass and nickel goods, which are sent to all parts of the world; it has a state school for the metal industry. It developed into a manufacturing town in the 15th century. The zinc-ore mines began to flourish in 1751, the manufacture of brass becoming prominent at the beginning of the 19th century. The surroundings are rich in picturesque grottos, hills and dales. Pop. 1925, 31,051.

ISHAM, SAMUEL (1855-1914), American painter and critic, was born at New York City, May 12, 1855. After being admitted to the bar, he decided to take up painting and went to Paris where he gained some reputation. Isham is represented at the Metropolitan Museum by his *Portrait of La Marquise de Carabas.* His *History of American Painting,* published 1905, is a notable work. Isham died at Easthampton, N.Y., June 12, 1914.

ISHMAEL (Hebrew for *God hears*), in Biblical history Abraham's son who was driven into the wilderness with his mother Hagar, Genesis 21:14. He is represented as a man whose hand "will be against every man, and every man's hand against him," Genesis 16:12. The Mohammedans regard Ishmael as their ancestor and his twelve sons as the founders of as many Arabian tribes.

ISHPEMING, a city in Marquette Co. in northwestern Michigan, situated 16 mi. southwest of Marquette. An airport, bus and truck lines and three railroads serve the city. The city is the center of the Marquette iron range district and has large iron mines. Gold, copper and asbestos are also found in this district. Ishpeming manufactures corsets. The region

engages in dairying and farming, with potatoes the chief crop. Ishpeming was settled in 1850 and incorporated in 1873. Nearby is Marquette State Park. Pop. 1920, 10,500; 1930, 9,238.

ISHTIP. *See* SHTIP.

ISIS, the ancient Egyptian goddess of fruitfulness, was daughter of Nut or the Sky, mother of Horus and wife of Osiris, King of Egypt. Set, the god of evil, led a conspiracy against Osiris and had him trapped in a chest and thrown into the Nile. The chest was cast up on the seashore where Isis found it. While she was seeking her son to avenge his father, Set also came upon the chest. He then cut Osiris's body into 14 pieces and scattered them



COURTESY METROPOLITAN MUSEUM OF ART

ISIS LEADING NEFRET-IRY

Painting from the tomb of Nefret-Iry in the Valley of the Queens, Thebes, 19th dynasty

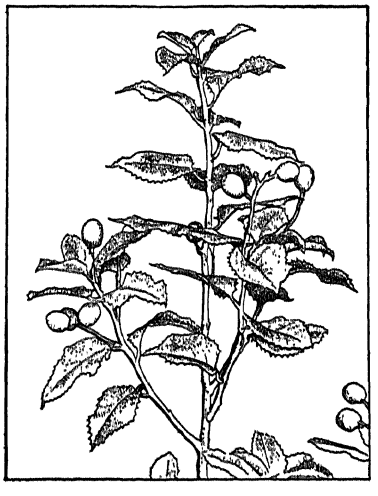
through Egypt. Isis traveled over the land and erected a temple over each spot where a part of the body lay. Horus fought and imprisoned Set, but Isis released him, for which Horus cut off his mother's head. Thoth, the god of magic, replaced it by the head of a cow. Isis is pictured with a woman's face and cow's horns. Her worship was universal in Egypt.

ISLAM. The word Islam and other derivatives come from the Arabic *salama,* to be safe and sound. This is the basis of the common Oriental salutation "Salam." Islam means to submit, or to resign one's self. *Al-Islam,* the resignation, is the name of the true religion, according to Mohammed, and the *muslim* is one who has truly submitted to Allah. Moslem doctors have used the term House of Islam (*daru'l-islam*) in contradistinction from House of War (*daru'l-harb,* i.e., the non-Islamic world). *See also* MOHAMMEDANISM.

ISLAND NO. 10, BATTLE OF, Apr. 7, 1862, an engagement of the CIVIL WAR which resulted in a Confederate disaster. Having driven the garrison of 9,000 Confederate troops from New Madrid, Mo., on Mar. 14, Major General John Pope and Flag-Officer Foote proceeded against the newest Confederate stronghold, Island No. 10, an upland in the Mississippi protected by impassable swamps. Directing skillful engineering operations which opened a canal from the Mississippi to New Madrid, whereby vessels could reach the town without passing the island, Pope offset the natural defenses of the location. As the island was invested by both the fleet and by Pope's land forces of over 12,000 troops, the Confederates surrendered without offering battle. On the next day the garrison attempted a surreptitious retreat, which was intercepted by Pope; 7,000 men were taken prisoners, and large quantities of guns and stores confiscated.

ISLAND UNIVERSE, the descriptive name given in astronomy to spiral nebulae and other stellar systems at vast distances and of enormous dimensions.

ISLAY (*Prunus ilicifolia*), a handsome evergreen shrub or small tree of the rose family, allied to the cherry laurels. It is a native of California where it is generally planted as an ornamental for its holly-



ISLAY OR HOLLYLEAF CHERRY

like foliage. The plant bears stiff, glossy, spiny-toothed leaves, small white flowers in narrow clusters and red or purple, thin-fleshed, astringent fruits (*drupes*), with a large, brittle-walled stone.

ISLE OF PINES, a small island of the West Indies, 40 mi. south of the west coast of Cuba, of which it is a dependency. Area about 1,000 sq. mi. Three-quarters of the island's surface is high or moun-

tainous, the remainder low and swampy. The highlands possess rich valleys, fertile tracts of which were purchased by Americans for the purpose of forming a colony. Although confirmation of Cuba's ownership was unexpected, American capital was not withdrawn. In spite of a tendency to overestimate its resources as a citrus center, there are extensive and excellent groves of orange, grapefruit, limes and lemons. Mineral water is the chief export of the island, which has many springs rich in magnesia. There are quarries of valuable marble in the Crystal Hills, which are covered with forests of fine woods. Cattle raising, potato, pineapple and citrus fruit cultivation are the chief occupations of the inhabitants. The climate is healthful.

The Isle of Pines was discovered by Columbus and named Evangelista. Its modern name is derived from its pine trees, which grow here at a lower level than in other parts of the tropics. Pop. 1931, 9,454.

ISLE ROYAL, a large island in Lake Superior, situated north of the state of Michigan and near the International Boundary line. It is intersected by latitude 48° N. and longitude 89° W. It is approximately 45 mi. long, has a maximum width of about 13 mi. and forms part of Keweenaw Co., Michigan. The chief settlement is Minong.

ISLETA, an Indian pueblo located on the west bank of the Rio Grande River about 10 mi. south of Albuquerque, N.M. Since before 1629 it has been the seat of the Franciscan mission of San Antonio de Isleta. In 1675 the population was increased by immigrations from nearby pueblos owing to Apache attacks; in 1680 when the village took part in the Pueblo revolt the population was around 2,000. The inhabitants of Isleta are a peaceful group who carefully maintain their aboriginal customs and social organization. They speak the Tigua dialect of the Tanoan linguistic stock. The population is approximately 1,000.

ISLETA DEL SUR, a Tigua pueblo on the northeast bank of the Rio Grande, near El Paso, Tex. It was founded in 1681 by Indian captives from the pueblo of Isleta in New Mexico, brought there by Gov. Otermin after the Pueblo revolt of 1680. Its modern inhabitants are entirely Mexicanized.

ISMAIL, capital of the Rumanian district of the same name in Rumania. It is built on the north bank of the Chila, a branch of the Danube and is a thriving commercial center. There are several grain mills, brick and pottery kilns, saw mills and tallow refineries. The most important exports are grain, hides, matched wood, tallow and wool. Prior to the 17th century, Ismail was under Turkish rule but was taken by the Russians about 1630. Since then it has been taken and retaken several times and was finally given to Rumania by the Allies after the World War. Pop. 1930, 26,123.

ISMAILIA, a small city of Lower Egypt, situated on Lake Timsah, a salt lagoon through which the Suez Canal passes, about 90 mi. northeast of Cairo by rail.

It was founded in 1863 as headquarters for the builders of the Suez Canal. The city is well laid out with many trees in its gardens. The Ismailia Canal from the Nile forks north and south beside the Suez, and, as the Sweetwater Canal, flows to Port Said and to Suez, supplying these cities with drinking water. Thus it fulfills one of the conditions laid down when the concession for the ship canal was granted. Pop. about 11,000.

ISMAILIANS, a Shiite sect of Moslems, known also as Seveners because their "imamate" (*see* IMAM) closed with Ismail (d. 875), seventh in line from Ali. Hasan Sabah, founder of the ASSASSINS, was an Ismailian. He and his successors had the support of the whole body in their dealings, both with the Sunni Moslems and the Crusaders. Since 1300 the sect has wielded little political influence. As religionists they exist in various lands, including India, where they are known as Khojas, whose head is the well-known Agha Khan. They are rationalists in morals and theology.

ISMAIL PASHA (1830-95), Khedive of Egypt, was born Dec. 31, 1830, son of Ibrahim Pasha. In 1861 he put down a rebellion in the Sudan and was made viceroy of Egypt when Said, Vali of Egypt died. Ismail Pasha increased the army and navy, extended his rule, secured hereditary succession to the throne in his direct line and obtained the right to be called Khedive. His growing power and extravagance gave occasion for intervention by western powers who in 1879 forced him to abdicate. He died at Constantinople, Mar. 21, 1895.

ISMENE, in Greek mythology, daughter of OEDIPUS and Jocasta, and sister of Antigone, was known for her devotion to her sister.

ISOBAR, a line drawn on a meteorological chart connecting points where the barometric pressure is the same, either for a given instant, or as indicative of the average conditions over a long period of time. Where they are highly curved closed lines they show the presence of cyclonic "lows" or anticyclonic "highs." Their instantaneous position and its change are of importance in the forecasting of weather.

ISOCHOR, a line, on the thermodynamic diagram for a gas, which represents the pressures corresponding to changes in temperature at constant volume. *See also* THERMODYNAMICS.

ISOCLYNIC LINES, lines drawn on a map through those points on the surface of the earth where the magnetic inclination, or the angle by which the lines of magnetic force are tipped with respect to the horizon, has the same value.

ISO-COMPOUNDS. Compounds which possess the same chemical elements in the same proportion but differ in their properties are called "isomerides" (Berzelius, 1830) or isomers. There are several ways in which such ISOMERISM can occur. The most common type is found in cases where the compounds have different chemical structures, e.g., there are two substances with the formula C_2H_6O: ethyl alcohol (C_2H_5OH) and dimethyl ether (CH_3OCH_3). In

such cases the compounds possess different chemical properties as well as different physical properties. There are substances in which the isomers possess the same chemical structure but differ in the special arrangement of the groups within the molecule, e.g., two lactic acids, $CH_3CHOHCO_2H$, are known. Chemically these two acids are identical, but they differ in their physical effect upon plane polarized light which is passed through them.

As the number of atoms present in a molecule becomes greater, the number of structural isomerides of any given composition increases enormously. There are possible two compounds having the formula C_4H_{10}, three of C_5H_{12}; five of C_6H_{14}; nine of C_7H_{16}; eighteen of C_8H_{18}; thirty-five of C_9H_{20}. L. C. A.

ISOCRATES (436-338 B.C.), Greek orator, was born in 436 B.C. at Athens. He studied under the greatest sophists of his day. Timidity and physical weakness kept him from a public career, and at first he applied himself to writing speeches for others. Later he became a teacher of rhetoric, opening a school at Athens in 392 B.C. Among his pupils were many eminent men, including the historians Ephorus and Theopompus, and the orators Isaeous, Hyperides and Lycurgus. Isocrates is chiefly important as the founder of a style of Greek prose which became a standard model for later Greek writers. His writings are characterized by a florid style and rhythmic smoothness of expression. We have under his name, 9 letters and 21 orations. Of the latter, the most famous is the *Panegyric*. Isocrates died at Athens in 338 B.C.

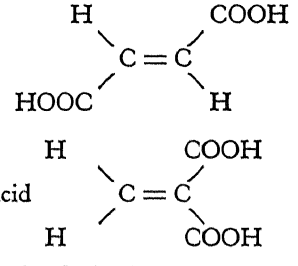
ISODYNAMIC LINES, lines drawn on a map through those points on the surface of the earth where the total magnetic force has the same intensity.

ISOGLOSS, a linguistic phenomenon found throughout a certain area as contrasted with a kindred phenomenon found throughout a certain other area. Thus the CENTUM-LANGUAGES have the common isoglottic feature of representing an Indo-European *ḱ* by a palatal, whereas the SATEM-LANGUAGES represent it by a sibilant; or northern FRENCH retains *c,* while standard French changes it to *sh* (written *ch*), as Latin *castellum,* Norman *castel* (whence English *castle*), Old Parisian French *chastel* (Modern French *château*); or the chief distinction between Low and High GERMANIC, as English *daughter,* German *tochter*. Isoglottic lines may thus be marked to delimit every type of manifestation of language—sound, intonation, inflection, syntax and vocabulary (isophone, isotone, isomorph, isosyntagme, isolex); and such lines will be found to cross in bewildering complexity, since isoglosses seem to be independent of each other. The study of isoglosses is still in its infancy, and their origins are not always the same, some being due to inheritance from a common source, and others evidently being independent parallel developments, so that each must be investigated both on its own merits and in combination with the whole complex of the linguistic area under consideration at the time.

L. H. G.

ISOGONIC LINES, lines drawn on a map through those points on the surface of the earth where the magnetic declination, or the angle between the direction of the magnetic force and the true north, has the same value. *See also* DECLINATION, MAGNETIC.

ISOMERISM, the name given in chemistry to the phenomenon by which two organic substances, both containing the same relative proportion of the same elements, may yet possess entirely different chemical or physical characteristics. Different classes of isomerism are distinguished: when the molecular formula of one substance is a simple multiple of that of another, such as of a sugar ($C_6H_{12}O_6$) and formaldehyde (CH_2O), one speaks of POLYMERIZATION; where the molecular formula is accidentally the same but the structure entirely different, as with the methylester of acetic acid, CH_3COOCH_3, and the ethylester of formic acid, $HCOO{\cdot}C_2H_5$, both having the molecular composition $C_3H_6O_2$, the description *metameric* is used. True isomerism is said to exist, e.g., between the three different di-brom benzenes, $C_6H_4Br_2$, where the two bromine atoms attached to the benzene ring may be adjacent, separated by one hydrogen atom, or oppositely placed, and between propyl alcohol $CH_3{\cdot}CH_2{\cdot}CH_2OH$ and iso-propyl alcohol, $CH_3{\cdot}CHOH{\cdot}CH_3$. In cases such as those of benzoquinone, or hydrocyanic acid, the latter of which may act as if it possessed simultaneously the two different formulae $H-C\equiv N$ and $H-N\equiv C$, *tautomerism* is said to occur; while if the two molecules contain identically the same groups, but the structural symmetry of the position of these groups is different, they are called *allo-isomeric* as, e.g., fumaric acid



and maleic acid

When one molecule is the mirror image of another, *optical isomerism* exists; usually such substances rotate the plane of polarized light, each in a different direction. W. J. L.

ISOMETRIC LINE, in THERMODYNAMICS, a line on a pressure-volume diagram indicating constant-volume changes.

ISOMETRIC SYSTEM, in CRYSTALLOGRAPHY, a system in which minerals are said to crystallize when their faces can conveniently be described by referring them to three imaginary axes of equal length, intersecting at right angles at the center of the crystal.

ISOMORPHISM, term used to denote similarity of crystal structure of chemically different substances. Isomorphism is best exemplified by compounds showing close chemical analogy (e.g., the "alums") and depends primarily upon the arrangement of atoms in space lattices identical in pattern and symmetry ex-

cept for slight differences of dimensions or angles. Partial or complete interchangeability of atoms, without change of crystal structure, resulting in "isomorphous mixtures" ("solid solutions," "mixed crystals") of intermediate composition, is the chief criterion of isomorphism. Crystallographic studies of chemical substances, minerals, and metals, are systematized, and chemical and physical relationships of solids are indicated, by the application of the principles of isomorphism. *See also* CRYSTALLOGRAPHY. C. W. M.

BIBLIOGRAPHY.—Groth-Marshall, *Introduction to Chemical Crystallography,* 1906; Jeffries and Archer, *Science of the Metals,* 1924.

ISOPRENE, a volatile, doubly unsaturated HYDROCARBON (C_5H_8), chiefly obtained by cracking India rubber, or related substances. Under the influence of heat, light, aging, or of substances such as alkali metals, strong acids, or carbon dioxide, it is capable of polymerizing (*see* POLYMERIZATION) to a rubber-like material, commonly termed synthetic rubber (*see* RUBBER, SYNTHETIC). Isoprene is unanimously regarded as the fundamental unit from which the rubber molecule is built, but the manner in which the isoprene units are linked to form the rubber edifice is still debated. The possibility of manufacturing isoprene economically is regarded as the essential factor in the commercial production of artificial rubber. Attempts to manufacture isoprene from isopentane, or selected gasoline fractions have been disappointing.

A. L. H.

ISOPTERA, the scientific name for an order of insects known popularly as termites or white ants. They live in colonies made up of reproductive individuals, which may be winged or wingless, and sterile wingless females, usually of two principal kinds, workers and soldiers. The winged males and females leave the old colony and establish new colonies. Then they lose their wings. Termites are generally light in color, and resemble true ants in shape.

ISOSCELES TRIANGLE. A triangle with two equal sides. The word is from the Greek for equal legged. The ancients usually represented their isosceles triangles in the form here shown, so that the equal sides *b* and *c* stood like legs. In modern usage an EQUILATERAL TRIANGLE is considered as a special type of isosceles triangle. The most important property of an isosceles triangle is that the angles opposite the equal sides are equal.

ISOSTASY, the hypothesis which assumes a compensation or equilibrium in the earth's crust. This compensation is brought about by the fact that the heavy mountain masses are supported by layers of comparatively light rock, while the ocean floor is formed by thick layers of very heavy rock, thus causing the total weight of the surface layers of the earth to average up about the same when depths of about 60 miles are considered.

ISOTHERM, a line drawn upon a meteorological chart, connecting places where the temperature is the same, either for a given moment, or as an average taken over a long period of time. In the former case their position and change are of value in the forecasting, as of a cold wave, while in the latter they are indicative of the general climatic conditions in different localities on earth.

ISOTHERMAL PROCESS, the name given to that series of changes in pressure and volume which a gas may undergo while its temperature remains constant. Since changes in pressure and volume signify a change in the amount of energy possessed by a gas, isothermal changes are accompanied by an interchange of heat between the gas and its environment. Thus, when a gas is expanded, it would naturally cool, and hence it must absorb heat in order to keep a constant temperature; similarly when a gas is compressed it would naturally become warmer, and must give off some of its heat in order to maintain its temperature constant. A true isothermal process is almost impossible of realization in practice, and can be approached with any degree of approximation only when the changes are made exceedingly slowly. It is, however, of great importance in theoretical investigations. *See* THERMODYNAMICS.

ISOTOPES, substances having the same chemical and physical properties but differing slightly in ATOMIC WEIGHT. It has been shown by studies of positive rays and radioactive (*see* RADIOACTIVITY) changes that practically all elements having atomic weights which are mixed numbers consist of several of these substances. Having the same properties, isotopes are placed together in the PERIODIC SYSTEM. *Iso* means *same,* and *topos, place.* When once mixed together, isotopes cannot be separated, except in a few rare cases.

It is of fundamental importance that the atomic weight of each isotope is a whole number. This suggests that the nuclei of all ATOMS are built up of multiples of a common material. The two isotopes of NEON have atomic weights of 20.0 and 22.0, while the chemically determined atomic weight of neon is 20.183. But these two kinds of neon are always found together in such proportion as to give the same intermediate atomic weight. CHLORINE, IRON and ARGON, have two isotopes; there are three kinds of magnesium and SILICON; and there are eleven isotopes of TIN.

Aston has shown that the atomic weights of isotopes differ by an exceedingly small amount from whole numbers. This difference is not greater than a few parts in 10,000. J. B. H.

BIBLIOGRAPHY.—F. W. Aston, *Isotopes,* 1924; E. N. da C. Andrade, *The Structure of the Atom,* 1927.

ISRAEL, (Hebrew for *God rules*), the Biblical appellation for Jacob, the father of 12 children and the ancestor of the 12 tribes. The Hebrews or Jews were therefore known as the descendants of Israel and the term Israel later came to be applied to the nation as a whole. When 10 of the tribes set up a separate monarch after the death of Solomon, the name was restricted to mean only these tribes. The term is still used to-day to indicate the Jews, considered as a unit and in relation to their religious and spiritual bonds.

ISRAËLS, JOZEF (1824-1911), Dutch genre painter, was born at Gronigen, Jan. 27, 1824, of Jewish parentage. He studied in Paris under Picot and Delaroche, returning to Holland in 1847. His earliest works were historical canvases but a sojourn in the fishing village of Zandvoort inspired in him a deep sympathy with the common tragedies of the poor. His depictions of peasant life are broadly impressionistic in brushwork, deeply compassionate in feeling. Of Israëls's many canvases, 30 of the best are in the Rijksmuseum, Amsterdam, and seven are in the Metropolitan Museum, New York. Israëls died at The Hague, Aug. 12, 1911.

ISSIK-KUL, a lake in central Asia, lying at the elevation of 5,165 ft. in the heart of the Tien-Shan between the Ala-tau Kunger and the Ala-tau Taskei ranges. It has an area of about 1,996 sq. mi., being 112 mi. long by 38 broad. Although it receives 40 rivers it has greatly diminished in size, as shown by the water marks fully 200 ft. above its level in the early part of this century. The surface falls 8 or 9 in. a year. This salt lake appears to be now a closed basin, but must have at one time communicated through the Kutemaldi with the Chui, which at present sends some of its water into the lake, so that it was once both an inlet and an outlet from Issik-kul.

ISSUS, BATTLE OF, 333 B.C., a battle fought near the town of Issus in Asia Minor by Alexander the Great against the Persian king Darius III. The battle was an incidental event in the course of the occupation of Syria and Phoenicia by Alexander's forces. The great Persian army was decisively defeated, Darius fled to the East and the Persian king's harem fell into the hands of Alexander. A famous Pompeian mosaic which depicts graphically the wild charge of Alexander that led to his victory at Issus has been excavated and is now preserved at Naples.

ISTANBUL, formerly known as **CONSTANTINOPLE,** the largest city of Turkey, situated at the southern entrance to the Bosporus and scattered on promontories overlooking the Sea of Marmora and the Golden Horn, an inlet 4 mi. long which divides Constantinople into its two main parts, Stamboul and Pera. Pera is on the northern side of the Golden Horn and is the more modern, or European part of the city. It contains the commercial and financial institutions as well as the wharves, the customhouse, the smart hotels and the embassies and legations of the foreign nations, most foreign representatives still residing in Constantinople although Ankara (previously Angora) is the capital. Stamboul occupies the ancient site of Byzantium and is the center of Mohammedan life. It is by far the more colorful section of the city, the streets being narrow and tortuous, paved with cobblestones and overhung with balconied wooden houses. Towering above the jumble of houses and the labyrinth of streets are the famous mosques, erected by the long line of distinguished sultans and named after them. Besides St. Sophia, the magnificent Byzantine church which the Turks converted into a mosque upon their capture of Constantinople in 1453, the most notable of the mosques of Stamboul are those of the Sultan Suleiman, the Sultan Selim, the Shah Zadeh, the Rustem Pasha and the Sultan Ahmed. The Sultan Suleiman mosque was built in the 16th century and is surmounted by a dome even higher than that of St. Sophia. It has four high minarets and an interior resplendent with marble ornaments. The Rustem Pasha, the Shah Zadeh and the Sultan Selim mosques were also erected in the 16th century and are remarkable examples of Turkish architecture. The Sultan Ahmed mosque, begun in 1609 and completed in 1614, is one of the largest in the world, having six minarets. The seraglio, long the home of the sultans, overlooks the Bosporus, commanding one of the loveliest views in the world. It is now a museum, treasuring the personal properties of the sultans and sultanas and containing some of the costliest creations of Mohammedan art.

The industrial and commercial importance of Constantinople has been dwindling for the last two decades, and the city is at present in a state of stagnation. The population, which was over 1,000,000 before the World War, is now but half of that. The Balkan War of 1912, during which Turkey lost much of her European possessions, the World War which followed it, and the Greco-Turkish War of 1921-22 with the consequent removal of the Turkish seat of government to Angora, have had a disastrous effect upon Constantinople. It is still the center of the silk industry of Turkey and there are thousands of small manufacturing establishments producing a variety of handmade articles, such as knives, pots, copper, brass and ironwares, carpets, rugs and embroideries, but the citizens are patronizing the shops of Pera where factory-made goods, imported from Europe, are to be had at cheaper prices. Of the old bazaars which gave Constantinople much of its erstwhile color and picturesqueness, the Grand Bazaar in Stamboul is still open. It is a labyrinth of twisting, vaulted passageways lined with innumerable shops displaying articles of Oriental make.

The fisheries of the Bosporus form a vital part of the city's commercial life; besides, Constantinople remains the largest port of Turkey. It has excellent harbor accommodations and in 1928 some 7,000 vessels with a gross tonnage of 12,000,000 cleared from the port. Two main railways have their terminals at the Bosporus. The international line passing through Eastern Thrace brings the Orient Express from Paris; the Anatolian line starts from Haidar Pasha, on the Asiatic side of the Bosporus, and proceeds eastward toward Izmid, Eski-Shehir, Angora and other important cities of Asia Minor. In the summer, airplane passenger service is maintained with Rome, Athens, Bucharest, Sofia and other capitals.

For administrative purposes the suburb of Scutari on the Asiatic shore is included in Constantinople, which is administered by a prefect appointed by the minister of the interior.

Among educational institutions still conducted by

foreigners Robert College, founded by American missionaries in 1863 and maintained by funds raised in America, is the most important. The various nationalities, such as Greeks, Bulgarians and Armenians, who had their national schools before 1914, are still allowed to keep them, but no permits are issued for new foreign schools. These schools are bound up with the churches of these nations, since Constantinople remains to-day the religious capital of the Greeks, the Bulgarians and the Armenians, the religious heads of which nations reside in Constantinople. Of Turkish educational institutions the National University, occupying the premises of the old War Office of Imperial Turkey, is the largest.

Constantinople was founded by Greek colonists in the 6th century B.C. and was called Byzance, or Byzantium. In 330 A.D. Emperor Constantine the Great made it his capital, changing its name to Constantinople. Until 1453, when Mohammed II captured it and made it the capital of the Ottoman Empire, the city was first the capital of the Eastern Roman Empire and later of the Byzantine Empire. In 1203 and 1204 it was invaded and pillaged by the Crusaders. Bulgarians, Huns and others repeatedly besieged it. In 1878 the armies of Russia reached the gates of the city and in 1912 the Bulgarians nearly took it. During the World War Constantinople was blockaded by sea and suffered severe privations. From Nov. 13, 1918, to Oct. 2, 1923, it was under the occupation of Great Britain, France and Italy. On Mar. 3, 1924, it was abandoned as the capital of Turkey and the Caliph Abdul Medjid was expelled from it. Pop. 1927, 690,857.

ISTANKENI. *See* Cos.

ISTHMUS, a narrow strip of land joining two larger seagirt bodies, as two continents, or a peninsula and the mainland. The Isthmus of Corinth, uniting Greece to the Peloponnesus, was the most famous neck of classic times. The cutting by canals through the Isthmus of Suez, between Asia and Africa, and through the Isthmus of Panama, linking North and South America, has enormously facilitated world trade.

ITACOLUMITE. *See* Sandstone.

ITALIAN DRAMA. *See* Italian Theater, The.

ITALIAN LANGUAGE, an important Romance language and, in its literary form, essentially the dialect of Florence as French is that of Paris. Generally speaking, it has remained much more faithful to Latin than has French, although its earliest documents are considerably younger than those of the latter. It diphthongizes only Latin *ĕ* and *ŏ* (Italian *pie(de)* "foot," *nuovo,* "new," = Latin *pede^{m}, novu^{m}*); and the number of vowels remains about the same as in Vulgar Latin. Italian consonantal changes, on the other hand, are remarkable. Like French, it sonorizes an intervocalic labial, e.g., Vulgar Latin *adripare* = Italian *arrivare,* French *arriver,* "arrive"; it generally doubles a consonant where French palatalizes a guttural, e.g., Latin *tectu^{m}* = Italian *tetto,* French *toit,* "roof"; and *l* is palatalized when preceded by an explosive, e.g., Latin *flamma* = Italian *fiamma,* French *flamme,* "flame."

The verbal system contains many features common to French and other western Romance: the formation of the future with the infinitive plus *habeo,* as *amare* plus *ho* = *amarò,* "I have to love" = "I shall love," and a similar type of conditional, but with the preterite instead of the imperfect as in French or Spanish, as Vulgar Latin *vendere habuit* = Italian *venderebbe,* "he had to sell" = "he would sell," but Vulgar Latin *vendere habebat* = French *vendrait,* Spanish *vendría.*

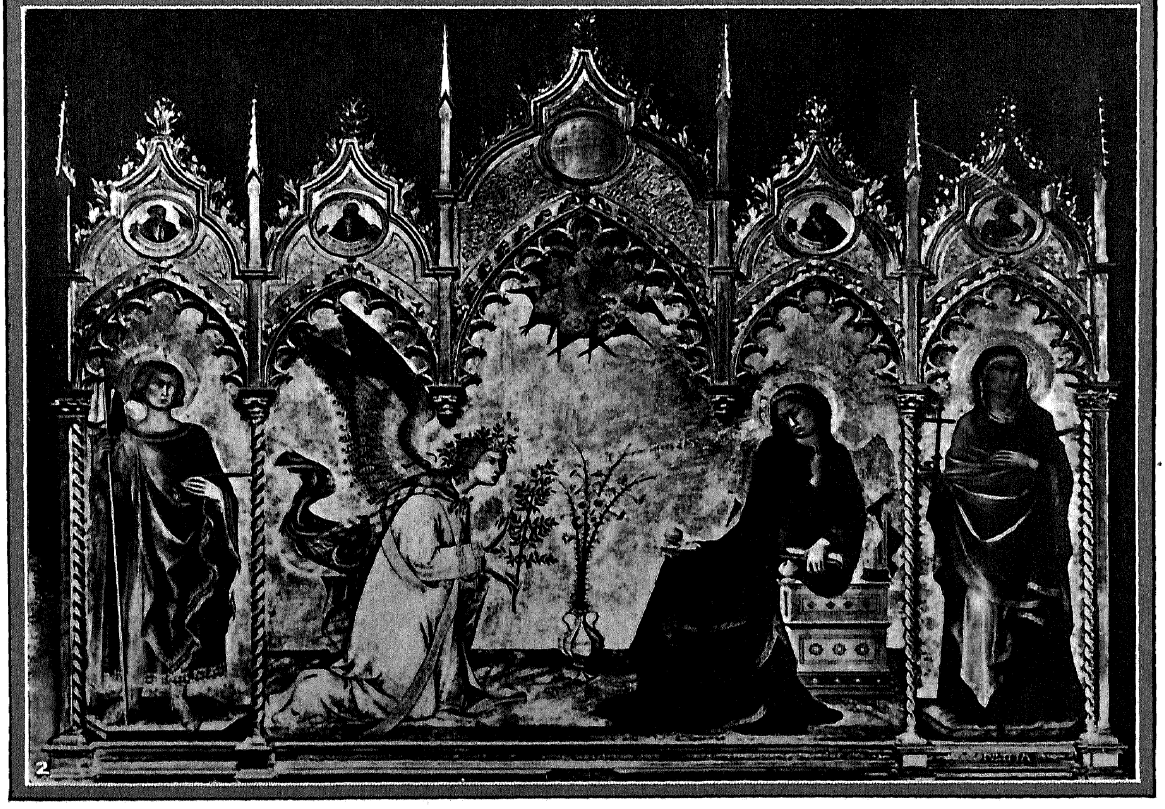
H. F. M.

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ITALIAN LITERATURE. Although it is possible to speak of the existence of an Italian literature in the 11th century, when the chronicle, still written in Latin, ceases to be chiefly monastic and begins to deal freely with secular and communal matters, the first literary documents of the Italian language are not to be found before the beginning of the 13th, or possibly toward the end of the 12th century. The early appearance of an original and independent Italian vernacular or "vulgar" tongue, which became detached from the Latin stem following the same process of differentiation that brought about the development of the other Romance languages, Provençal, French, Spanish, Portuguese, Catalan, Rumanian, coincides with a series of economic, social, political and religious revolutions embracing the first three centuries of the second millennium, and marking in Italy, earlier than in any other European country, the decline of the Middle Ages. The Norman conquest of the South, the social-economic uprisings in the north, and the movement of reform of the Church and Papacy in the 11th century; the bitter struggle between Church and State, and the coming of a third factor—the Italian middle classes, organized in the so-called republics—throughout the 12th and 13th centuries—all these phenomena characterize the birth of a new Italy and lay the foundations for the development of a new language and an independent literature.

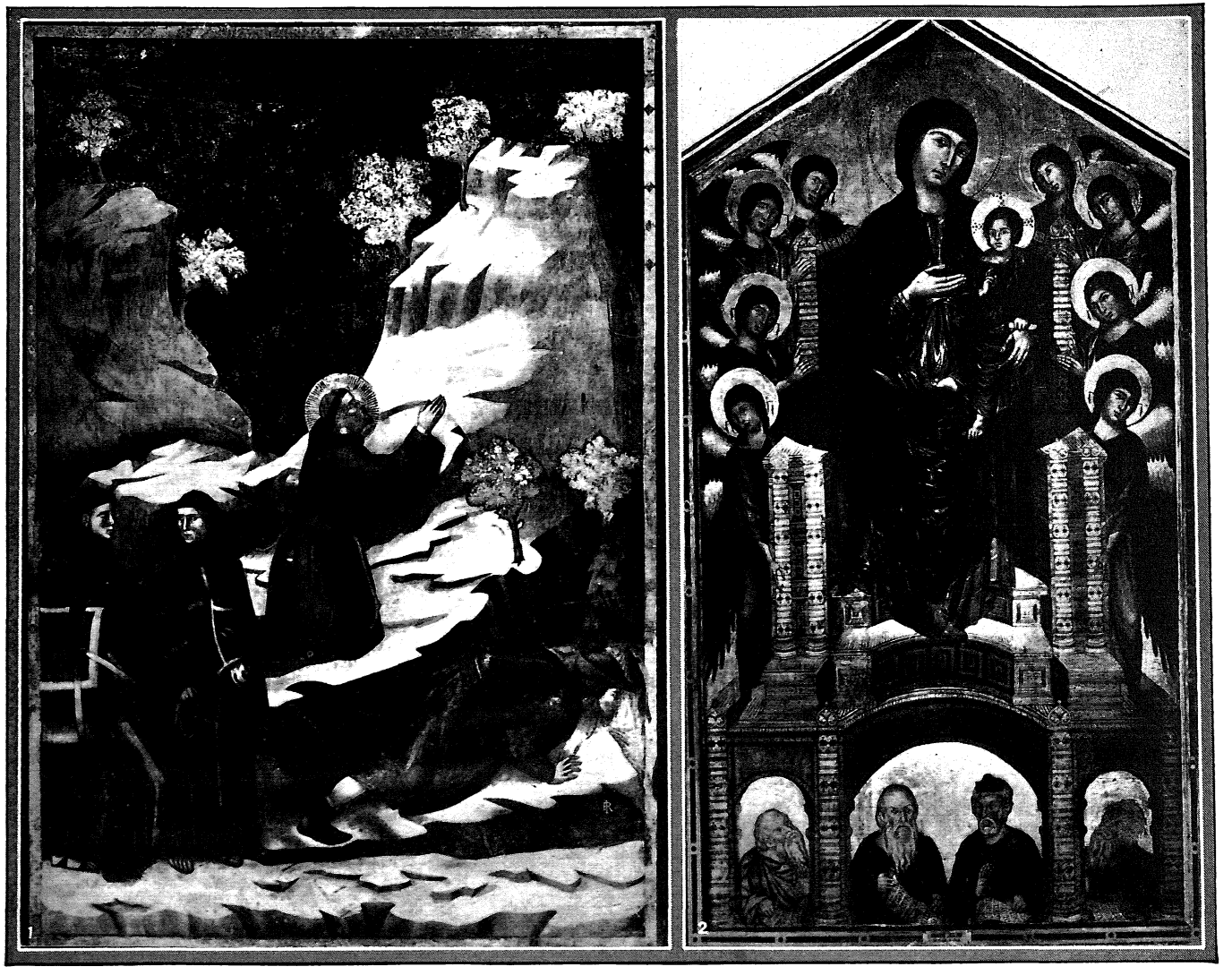
From the end of the 12th century to the present, the history of Italian literature may be divided into seven periods: the Origins, the Tuscan period, the first phase of the Renaissance, or Humanism, the second phase, or High Renaissance, the Decadence, the Revival and the Contemporary period. These distinctions are naturally quite artificial and arbitrary. They are, however, of a certain value in so far as they roughly correspond to the limits of the seven centuries of the development of Italian literary history. All the more so, since the names of some of these centuries, as the *Trecento,* or 14th century, the *Quattrocento,* 15th century, and the *Seicento,* 17th century, are accepted and used also outside Italy as indicating the literary, artistic and cultural achievements of those respective periods.





ITALIAN PRIMITIVE PAINTINGS

1. "The Death of St. Francis," by Giotto (1276?-1337). One of a series of frescoes in the Church of Santa Croce, Florence, which picture the life of the saint. 2. "The Annunciation," by Simone Martini (1283-1344), and Lippo Memmi (1317?-47?). In left panel, St. Ansanus. In right panel, St. Juliana. In the Uffizi Gallery, Florence.



EARLY ITALIAN PAINTINGS

1. "The Miracle of the Spring," a scene from the life of St. Francis, by Giotto (1276?-1337). In the church of St. Francis, Assisi.
2. "Madonna and Child enthroned with eight angels and four prophets," altarpiece by Giovanni Cimabue (1240-1302). In the Uffizi Gallery, Florence.

Origins. The earliest poetical document in Italian is perhaps the celebrated "Song in Praise of All Creatures" (*Canticum Creaturarum*), which ST. FRANCIS of Assisi intoned about 1224, two years before his death. It was just at this time that the Italian vernacular, or better, the Italian vernaculars, were emerging from the humble stage of a spoken tongue and were beginning to be used for literary purposes in prose as well as in verse. In the legends, prayers, songs and laments written in dialect or in a jargon, one can already distinguish the dawn of an original lyrical form.

Latin, Provençal and French were still the official languages of poetry, while prose was usually written in Latin and French. It was in the form of translations, centos, and adaptations of Latin, Provençal, or French texts, that the new "vulgar" tongues made their first appearance in a literary guise. Dante gave the name of *Sicilian School* to that group of rhymers who, although coming from all parts of Italy, had gathered in Sicily at the court of Frederick II, and who in colorless imitations endeavored to reproduce the poetry of Provence. In the north, several poet-philosophers grouped themselves about Guittone d'Arezzo (d. 1294), speculating on Woman and Love from the standpoint of an elaborate mysticism. The chief merit of the latter school consists in having given one of its followers, GUIDO GUINICELLI, praised by Dante as the father of the new Italian poetry, the opportunity of casting off all doctrinal fetters to follow the dictates of inspiration (*Dolce stil nuovo*). This period is commonly known as the pre-Dantesque age. And rightly so, for DANTE (1265-1321) occupies an outstanding position not only in literary history but in the history of the development of language as well.

Tuscan Period. The Italian language emerged, to remain substantially unchanged throughout the centuries, from the poetical experiments of the *Vita Nuova,* developed by Petrarch into a broader lyrical expression, and from the sculptured prose of the *Convivio,* which served Boccaccio as a model. The Florentine dialect prevailed over the others and rose to literary preeminence because of its persistence in reproducing the Latin tongue, its individual structure, its geographical and historical opportunities, and the excellence of the writers who first used it. This, however, does not imply that literary experiments were not to be made in other dialects. On the contrary, many of them, especially Sicilian, Neapolitan, Venetian, Piedmontese and Roman, not only survived but can boast even today of a literary activity which testifies to their intrinsic value.

The *Divine Comedy* of Dante, the *Canzoniere* of PETRARCH (1304-74), the *Decameron* of BOCCACCIO (1313-75), dominate the whole of the Tuscan period. They are the models upon which the later writers constantly depended for inspiration. Last but not least, with their strong sense of the Latin tradition, they lead to the revival of the Greco-Roman culture characteristic of the next period.

Humanism—a word formed upon the Latin *humanitas,* indicating the studies worthy of man and aiming at his educational formation—reaches its highest phase of development after Boccaccio's death. Although European in character, Humanism was chiefly marked in Italy by a learned fanaticism, the worship of classical beauty, and the cult of the political and social life of ancient civilization. The heritage of national literature, neglected and even contemptuously waved aside by the learned Humanists, especially in the early 15th century, was entrusted to the people and managed to survive. Though the tradition of national art and poetry was broken, nevertheless literature acquired new strength from this ardent activity and the imitation of classical form. This accounts for the development of historiography, criticism and philosophy. Hence the manifold interest of popes, prelates and princes in literary movements, one of the chief factors of the splendor of the Renaissance: one has only to remember Lorenzo the Magnificent (*see* LORENZO DE' MEDICI), dictator, poet and patron of the arts. Hence the rise of literary clubs and academies, in Rome, Florence and Naples, to mention only the three greatest literary centers, which kept alive the flame of culture during the dark years of the decadence. This humanistic period, moreover, furnished the soil for the amazing erudition of LEONE BATTISTA ALBERTI (1404-72) who, in his prose writings, combined the austerity of the Latin sentence with the grace of the Tuscan tongue, and in 1441 held a competition in Florence to reaffirm his faith in the challenged efficacy of the Italian vernacular, the so-called *Certame Coronario.* The political vision of MACHIAVELLI (1469-1527) has its roots in Humanism, as does the art of ANGELO POLIZIANO (1454-94), the finest poet of the Renaissance.

High Renaissance. The golden age of the Renaissance, embracing the whole 16th century, is properly speaking a national period: from Tuscan, literature actually becomes Italian and a uniform type of prose is found throughout the peninsula. The spreading of autocratic régimes (the *Signorie*), the patronage of arts and the brilliant life of the courts offered ample protection for literary activity, while at the same time undermining and distorting its free expansion. The poets of this age as typified in PIETRO BEMBO (1470-1547) tried vainly to achieve perfection of form following the footsteps of Petrarch. Spontaneity and robustness of feeling are found only in a few, such as VITTORIA COLONNA (1492-1547) and MICHELANGELO (1475-1564). Through a long series of minor attempts the development of historical writings leads to FRANCESCO GUICCIARDINI (1483-1540), unsurpassed in his power of organizing the facts of history and understanding their relations to life.

Now appear the first elements of literary genres destined to reach full development only in the following centuries: drama, satire and pastoral poetry. Above all chivalric literature rises, flourishes and declines during this age. Popular, burlesque, and roughly epical as it was in LUIGI PULCI (1432-84), rep-

resentative of the fat Medicean merchant class, it now becomes polished, romantic and chivalrous in MATTEO MARIA BOIARDO (1434-94), who combined the amorous legends of the Arthurian Round Table with the religious-military deeds of the Charlemagne cycle (*see also* ARTHURIAN LEGENDS); it reaches its full maturity in *Orlando Furioso,* by LUDOVICO ARIOSTO (1474-1533), in which all the different elements—epic, comic, chivalric—are fused in a superb synthesis of fantasy and art; declining finally, although still brilliant, with the attempt of TORQUATO TASSO (1544-95) to give Italy its long-awaited heroic poem and to bestow epical beauty upon the Catholic reaction which followed the REFORMATION and the Council of Trent.

Decadence. But the first germs of the decay are already perceptible. The new foreign invasions, starting in 1494 and steadily persisting until the middle of the last century, account for a great part of this. The sack of Rome, May 6, 1527, has rightly been called the death blow of the Renaissance in Italy. Art degenerates into BAROQUE and Rococo; moral, intellectual and religious life is at its lowest. In poetry the decadence takes the character of *Secentism* ("to astonish, this is the aim of poetry"); sincerity and spontaneity seem altogether lost. Yet, in spite of persecutions and repressions, the philosophical sciences struggle for life with Bruno, Campanella, Telesio; scientific studies reach their apogee with GALILEO (1564-1642), the true creator of modern Italian scientific prose; historical sciences can boast of the dignified and subtle protest of Paolo Sarpi (1552-1623), of the learned researches of L. A. MURATORI (1672-1750), and of the brilliantly confused speculations of GIAMBATTISTA VICO (1668-1744). Finally, towards the end of the 17th century, as a reaction against *Secentism,* the "Arcadia" appears, immediately falling, however, into the opposite extreme of unbounded mannerism, sentimentalism and artificial simplicity. In the political field, together with the slow growth of a national consciousness and of an equally conscious middle class, one witnesses the rise of the House of Savoy as a European power. In these three facts lies the key of the Italian *Risorgimento.*

The Revival. The social reformers of the 18th century, whose medium was the comedy of CARLO GOLDONI (1707-93) and Gozzi (1713-86), the satire of GIUSEPPE PARINI (1729-99) and the tragedy of VITTORIO ALFIERI (1749-1803), usher in the new phase of literary revival. Parini and Alfieri should also be credited with the most deliberate, original and effective contribution to the regeneration of Italian poetry. The French tricolor, which invaded Italy in 1796 and destroyed the old political structure, was responsible for a definite urge towards revolution and independence, a trend that was not checked by the HOLY ALLIANCE, the CONGRESS OF VIENNA of 1815, the Restoration of the old régimes, or the harsh reaction which followed it. The translation and imitation of foreign literatures—English and German as well as French—also slowly transformed Italian literature from a strictly national into a European movement and sharpened the desire for a new artistic expression. VINCENZO MONTI (1754-1828) and UGO FOSCOLO (1778-1827) are at the same time the last representatives of the old classical school and the forerunners of ROMANTICISM. The latter recapitulates in his agitated and wandering life, in his political beliefs and in his exalted "Hymn to the Tombs" (*I Sepolcri*) the new elements of Italian civic poetry.

The incertitudes of the transitional period, the feeling that one historical age was at its end and that a new one was just beginning, the natural restlessness provoked by the coming of the industrial revolution, find adequate expression in the pessimistic mood of GIACOMO LEOPARDI (1798-1837), one of the most striking personalities in all the long line of Italian writers. He wrested poetry from the conventional imitations of Petrarch and Dante, within the form of which almost every one of his predecessors, even the most vigorous, had been content to keep themselves. ALESSANDRO MANZONI (1785-1873), the recognized leader of the new Romantic school and the initiator for Italy of the historical novel, personifies on the other hand the superficial optimism, the self-satisfaction, and the meek liberalism of the new bourgeoisie rapidly emerging to power.

After 1830 literature is chiefly political: every form, every manifestation, becomes an instrument of struggle for independence and unity: the tragedy of G. Niccolini (1782-1861), the ballads of Berchet (1783-1851), the satire of G. GIUSTI (1809-50), the songs of Mameli (1827-49), the novels of AZEGLIO (1798-1866) and Guerrazzi (1804-1873), the history of BALBO (1789-1853), the mystico-political patchwork of Gioberti (1801-52), the intense and manifold activity of G. MAZZINI (1805-72). All these authors encourage and join in the efforts of the Italian upper and middle classes in their efforts to gain recognition.

Since 1870, political unity once achieved, Italy announced to the world that she was a European power and demanded the place to which she was entitled by her revived energies. The exploitation of the new social and economic resources on the basis of highly developed industry and of capitalism, the acquisition of colonies and of national prestige, the strengthening of national compactness, give the life of the country a new realistic trend, which naturally came to be felt in literature, art and intellectual activity in general. GIOSUÈ CARDUCCI (1835-1907), the archenemy of Romanticism in the field of poetry and literary criticism, and GIOVANNI VERGA (1848-1921) in the field of the novel, express the mood of the generation which witnessed the development of the naturalistic school in its varieties of neoclassicism and realism (*verismo*). Science, positivist history and Marxism (*see* MARX, KARL) take the place of the metaphysical researches of the first half of the 19th century. This naturalistic tendency is European, just as European had been the Romantic movement, during which most of the countries of Europe had realized their political unity.

Contemporary Period. The literature of Italy during these last 40 or 50 years attests the fact that the

country has fully entered the phase of industrialism and that the economic struggle has become the leading motive of history. From a positive angle this may be traced in the novels and plays of a bourgeois type, imitated from the French after the early decline of the realistic novel; in the political and social theories of Alfredo Oriani; and to a much greater extent in the cult of activism, lack of moral scruples, and volitionism of G. D'Annunzio, whose Nietzschean estheticism is thoroughly sincere only when he sings the egoistic and imperialistic exigencies of the new Italian aristocracy of industry and finance, which recognized in him its leader and its interpreter. Negatively this trend is felt in the sterile attempts of reformers and writers to bring about a return to past ages and to absurd systems of social and spiritual values: the Catholic neoromanticism of Fogazzaro, the intellectual donjuanism of Papini and his friends of *La Voce,* the vague humanitarianism of Pascoli, the neo-hegelianism of Croce, the religious criticism of the modernists led by Ernesto Buonaiuti, and the empty dilettantism of the futurists led by Marinetti.

The latest change in Italian life, which forced the intervention in the World War, 1915, and brought about the gradual rise of Fascism out of the exasperated social relations, with the open dictatorship of financial capital, has failed to give Italy a new literature. This is due to the widespread feeling that this phase represents the closing of an age, and not the opening of a new period, and that the present social system is on the verge of collapse. A pitiful stagnation of literary activity; a rapidly increasing development of moral and social relativism, as felt in the post-war *Grottesco* theater, in Luigi Pirandello and in the artificial controversies between traditionalists and ultra-moderns (*Strapaese* and *Stracitta*); an amazing wave of scepticism, as felt in some of the newest novelists, Moravia and Gromo, or in some representatives of the older generation, Papini in *Gog,* Panzini in his latest essays—all these are unmistakable symptoms that Italian literature, as well as Italian political and social life, is about to undergo a radical and decisive series of changes. The new literature will undoubtedly reflect in its development the rise and growth of the new social forces which are bound to mould Italy's new destinies. A. D.

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ITALIAN PRIMITIVES. The keynote struck by the Italian Primitives, in the cyclic revival of art at the dawn of the Renaissance in the 14th century, is still being sounded at the end of 600 years of artistic effort. Practically all the methods and traditions of the High Renaissance, and the essentials of what gives value to modern art down to the present day, had their origin in the work of Giotto (1276-1336).

The most famous of the precursors of the Italian School were Niccolo Pisano, Duccio, Simone Martini, Cavallini and Cimabue. Niccolo Pisano (1250-1320), the sculptor, through study of Roman fragments gave to the pillars and bas-reliefs of his marble pulpits a new mingling of classical dignity with qualities of life and movement. Duccio (1260-1339), founder of the Sienese School of Painting, sought to refine the grim, gaunt Byzantine silhouette by imparting a lyric quality of grace and sweetness. He was supported by Simone Martini (1285-1344) who deepened the note of pensive devoutness, in a setting of resplendent gold and sumptuous costume. Cavallino (1259-1344) worked out in Rome a new pictorial form suggestive of Hellenic statuary, disregarding emotion in favor of structure, drapery, and light and shade. Cimabue (1260-1302) formed the last link between the old spirit and the new. Faithful to the decadent mosaic formula, he tried to infuse into it a fresh spirit of humanity. In 1294 he was called to Assisi to decorate the church where St. Francis was buried. Among his assistants was Giotto. Not until about 1300 is there further mention of Giotto, at which time he was given the direction of the decorations when Cimabue went to Rome. He was now in his early thirties and in control of the craft he had learned from the great artists of the day summoned to adorn the church at Assisi.

At the dawn of the Renaissance three great men of profound significance were St. Francis of Assisi, in religion, Giotto, in painting, and Dante, in poetry. Giotto, as interpreter of the beloved troubadour saint, gave a religious stamp to Italian painting, and laid the foundation for the great Florentine tradition. (*See* Florentine School of Painting.) Each element was later to be taken up for special experiment by some artist, who by modifying and developing it gained brilliant results. Endowed with humor, imagination and reverence, Giotto grasped the essential and universal, seeing in the everyday life about him what had never before been seen. He instilled the poetry of St. Francis into his renderings of the saint's life, as seen in *St. Francis Preaching to the Birds.* In this scene he also proved his genius in one of his most complete and charming landscape backgrounds. If his knowledge of anatomy was defective, there is no obscurity, nor did he fail to convey the feeling of the figures under the clumsy but stately Roman draperies. Through line and color he gave a naturalistic quality, which later was to develop into the dominant trait of Italian printing.

Medieval in heart and modern in mind, there was the same close bond between Giotto and Dante, as with St. Francis. The allegorical trend of Giotto's more mature work may be traced to Dante's sojourn with him at Padua while the painter's symbolic figures were being conceived and executed, as was his design for the *Last Judgment.* The embodying of abstract ideas in allegorical figures was to become a custom and enter into the tradition of the Giottoesque. His group of pupils and admirers formulated and solved the difficulties of his innovations, and for the remainder of the century kept up the tradition, with some modification by the Sienese.

Chief among the School of Giotto were Taddeo Gaddi, Giottino, Giovanni da Melan, Orcagna, Spinello, Maso and Lorenzetti. The transition period subsequent to Giotto closes in the 14th century with the only great artist of the period, FRA ANGELICO of Fiesole. He formed the link between Giotto and Masaccio.

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ITALIAN SOMALILAND, an Italian territory extending along the east coast of Africa from Somaliland Protectorate to Kenya, consisting of two small protectorates in the north and a colony which lies south of 4½° N. lat. The total area covers about 190,000 sq. mi. of which 33,000 sq. mi. were ceded from Kenya in 1924 and known as Trans-Juba. The population of 1,200,000 includes 1,000 Italians. The region is a broad coastal lowland backed by upland which reaches an elevation of about 5,000 ft. in the north. Leading crops are *dura,* or MILLET, maize and sesame. The Italian colonists are interested chiefly in the cultivation of cotton. Camels, cattle and sheep are raised. Australian sheep have been introduced to improve the fleece of the native breed.

The territory is administered by a governor. MOGADISCIO, the capital, is also the principal port. Trade is conducted largely by Arabs and Indians.

ITALIAN THEATER, THE. Of the religious, Christian drama which prevailed in Europe generally in the Middle Ages between the 10th and 16th centuries, the Italians developed two particular types in the Italian language. The first was the Franciscan *lauda* (praise) or "devotion," which flourished between 1260 (Raniero Fasani's first "company" of *Flagellanti*) and the end of the 14th century, and found a masterpiece in the *Crucifixion* of Jacopone da Todi, 1268. The second was the "sacred performance," or "representation," a versified religious drama, pretentiously staged and costumed, and played with secular actors in public squares on occasions of municipal festivity. The sacred performance flourished between the 13th and 16th centuries (in 1547 Vasari notes that it had "fallen into complete desuetude"). Toward the end of the 15th century it attracted writers of prominence: Lorenzo de' Medici, the Magnificent (1448-94), author of the *Story of Saints John and Paul,* and Bernardo Pulci (1438-88), who wrote the *Story of Jehosophat.* The sacred performance was a briefer, more expeditious form of versified drama than the French MYSTERY PLAY, which itself had a restricted vogue in northern Italy.

Renaissance Types. The aristocratic courts of the 15th and 16th centuries were captivated by elegant, cultivated and exquisitely poetic verse dramas called Eclogues and PASTORALS. In these now extinct genres there are two Italian masterpieces: the *Orpheus,* 1471, of ANGELO POLIZIANO (1454-94), and the gorgeous *Aminta,* 1573, of TORQUATO TASSO (1544-95). In its day "The Faithful Shepherd" (*Il pastor fido,* 1590) of G. B. GUARINI (1538-1612) was a European sensation, but it is now read only by scholars. The eclogues and pastorals are to be accounted legitimate forebears of the modern grand opera: pageantry, music, ballets and sumptuous staging.

Origin of the Modern Play. However, the Italian Renaissance, between 1503 (first performance of *Calandria,* by Cardinal Bibbiena) and the advent of Molière in France, can claim the invention and early perfection of the modern play. Asserting the modern languages against Latin, the Italians transferred the plot of the Latin PLAUTUS (more particularly than that of TERENCE) into Italian, and developed the type-character, the comic situation and the elements of stage business. They also created the theater itself with the professional actor. The Italian professional or "company" comedy (*commedia dell' arte—arte* means trade, and here, company) had seasons for nearly 200 years, 1550-1750, in many of the principal cities of Europe, and in Italy knew the first celebrities of the stage—Andrea Calmo, Angelo Beolco and Isabella Andreini and her family. Characteristic of this professional comedy were the type character or MASQUE—Pantaloon, Harlequin, Punch, Zanni and the like, and the fact that the actors improvised their own lines and business, working on the basis of rough plots or scenarios. In the copious Italian drama exploited by the professional comedy there is but one play generally recognized as a masterpiece: the *Mandragola* of MACHIAVELLI (1469-1527). The *Suppositi* ("Disguises," 1509) of LODOVICO ARIOSTO (1474-1533) in translation by Gascoyne, is supposed to have influenced the form of Shakespeare's comedies. The plays of Pietro Aretino (1492-1556), G. B. Della Porta (1540-1615), Antonio-Francesco Grazzini (Lasca, 1503-84), and Angelo Beolco (Ruzzante, 1502?-42), are still read by scholars interested in the history of the modern stage.

In the same effort to adapt the art forms of antiquity to modern language, the Italians vulgarized the *Poetics* of Aristotle, developed the first theories of the drama, and gave the first illustrations of the dramatic genres. Their classical tragedy, of which the first example was the *Sofonisba* of G. G. Trissino, 1515, was a failure from the artistic point of view and knew no passable achievements before the very late *Merope* of S. Maffei, 1713, and the *Saul,* 1783, and other tragedies of V. ALFIERI (1749-1803) who was active between 1775 and 1789. However, this early Italian effort attracted wide attention in Europe and formed an essential part of the background for the brilliant outburst of tragedy in France in the 17th century: CORNEILLE, RACINE, down to VOLTAIRE of the 18th. Experimenting with theatrical types unknown to the ancients, the Italians developed elements from the pageant, the pastoral and the tragedy—in fact from the theater at large—into the melodrama, musical drama, or opera, of which the first example is the *Dafne* by Rinuccini-Peri, 1594; supplied some of the best of the early composers—Jacopo Peri, (*fl.* 1600), Francesco Cavalli (Pier Francesco Coletti-

Bruni, 1600?-76), Claudio Monteverde (1567-1643), and furnished the rank and file of Europe's operatic librettists, Ottavio Rinuccini (1565-1621), Gabriello Chiabrera (1552-1638), G. F. Busenello (1598-1659), Apostolo Zeno (1668-1750), Lorenzo Da Ponte (1749-1838), for at least two centuries, 1600-1800.

Goldoni. With the gift of the modern theater to Europe in her 16th century, Italy rests content; and thereafter her theater becomes more and more strictly national in reference and inspiration, and in forms and formulae follows the lead of other countries. An historical background of Spanish and more particularly of French experimentation is outlined behind the formula used by the great Italian comedy writer of the 18th century, CARLO GOLDONI (1707-93). Goldoni's "reform" put an end in Italy to the old professional comedy of masks, stock characters, improvisations and "slapstick," and, taking over the inheritance of Molière, established in Italy the dramatic individuality located in a realistic environment. Some of Goldoni's plays, *The Mistress of the Inn, The Fan, The Coffee House, A Strange Occurrence,* have entered world literature. A good quarter of his extensive repertory is alive on the Italian stage to-day. Unique in world literature, and still surviving, are the delightful dramatic "fairy-stories" of his contemporary and compatriot, CARLO GOZZI (1720-1806) —*Love affair of the Three Oranges* and *Turandot,* a type of *Jack and the Bean-stalk.* Writing especially for the opera, PIETRO METASTASIO (1698-1782) won world honors in the musical tragedy (*Didone* and others), and the lyrics in his plays constitute the Italian poetry of greatest world popularity after Dante, Petrarch and Tasso.

French Influences. Beginning with the Italian struggle for independence, 1796-1871, the Italian theater parallels, speaking in very general terms, the dramatic evolution of the French, and the French influence grows stronger as one approaches the contemporary period, though the tradition of Goldoni in comedy and of Alfieri in tragedy is present to the minds of most Italian writers all along. French ROMANTICISM has its Italian counterpart in the *Carmagnola* and *Adelchi* of ALESSANDRO MANZONI (1785-1873), though Manzoni was thinking of Shakespeare and consciously imitating Schiller. These tragedies, with Silvio Pellico's *Francesca da Rimini,* 1815, initiate a popularity of the romantic historical drama which was to hold the Italian field for a good century. The *Foscarini,* 1827, *Cenci,* 1844, and *Arnaldo da Brescia,* 1843, of G. B. Niccolini (1782-1861), outstanding in their day because of their patriotic sentiments, are now virtually forgotten. The transition from Romanticism to bourgeois realism-naturalism in France is reflected in Italy by Pietro Cossa (1830-81) whose *Nerone,* an Alfierian tragedy, still enjoys a fitful survival. Cossa's leadership in the '70s and '80s was contested by P. Giacometti (1816-82) who was exported by the great Italian actors, Adelaide Ristori (1822-1906) and Tommaso Salvini (1830-1916) and whose *Morte Civile* ("Legally Dead") is to-day as alive, one may say, as the *Camille* of Dumas. The French comedy of manners of the Dumas-Augier type was represented in Italy by PAOLO FERRARI (1822-89), otherwise a Goldonian, who bears to later Italian drama a position somewhat analogous to that of EUGÈNE SCRIBE in France. The later Becque-Zola phase of the same French movement is paralleled in Italy by Giuseppe Giacosa (1847-1906), who dominates the Italian '80s with plays in many different manners (*A Game of Chess,* 1871; *Like Falling Leaves,* 1900). Other survivals of the school are Girolamo Rovetta (1853-1910), *I disonesti,* 1892, and *Romanticisms,* 1903; Marco Praga (1862-1926), *The Ideal Wife,* 1890; Camillo Antona-Traversi (1867-), *The Flirt,* 1894; Alfredo Testoni (1859-), *Cardinal Lambertini,* 1909; S. Lopez (1867-), *Three for Diana,* 1912.

Reactions. The dominance of the French outlook in Italy has provoked various efforts at reaction: spectacular that of GABRIELE D'ANNUNZIO (1863-), supported by the great actress ELEONORA DUSE (1859-1924), in a poetic drama *The Dead City,* 1898; *Francesca da Rimini,* 1903; *The Daughter of Jorio,* 1904. Theatrically more noteworthy was an Ibsenesque trend initiated by E. A. Butti (1868-1907) in *Lucifer,* and *Flames in the Dark,* and carried further in the brilliant repertory of Roberto Bracco (1862-): *Unfaithful, The Hidden Spring, Ghosts, Lost in the Dark, The Little Saint,* 1898-1909. The effort to Italianize has continually stimulated a dialect theater; outstanding examples are Vittorio Bersezio (1830-1900), *The Troubles of Monsù Travett,* 1876; Giacinto Gallina (1852-97), *Family Quarrels,* 1872, *The Basis of Everything,* 1894; Libero Pilotto (1854-1900), *Il tiranno di San Giusto,* 1883; and the gems of Salvatore di Giacomo (1862-), *Assunta Spina,* 1909; *The Vow,* 1912. Sem Benelli (1877-) develops an interesting poetic-romantic play best illustrated by *The Jest,* 1909. Dario Niccodemi (1877-), despite some experimentation, is probably still French at bottom in *Refuge,* 1909, *Remnant,* 1915; *Stronger Than Love* (*La nemica*), 1916; *Passion* (*La Maestrina*), 1916. Ercole Luigi Morselli (1881-1921) attempts a mood of romantic Hellenism in his beautiful *Glauco.*

Pirandello. Since the World War the reaction against France has become more self-conscious and the Italian theater with its "grotesques" [for example, Luigi Chiarelli, (1878?-), *The Mask and the Face*] has attained international prominence in the plays of LUIGI PIRANDELLO (1867-): *The Pleasure of Honesty, Right You Are, Six Characters in Search of an Author, Henry IV, As You Desire Me,* 1916-31. Rosso di San Secondo (1886-), has also enjoyed a certain success in this modern temper with his *Marionettes.* Fausto Maria Martini (1881-1931) enjoyed an international success with his *Laugh, Clown, Laugh* ("Ridi, Pagliacci"). The most prolific stage craftsman of the newer generation is Giovacchino Forzano (1880?-) whose masterpiece is *Sly.*

Dramatic Organization. The external conditions of the Italian theater have not greatly changed in

400 years. Italy is a country of relatively small cities with no great metropolis such as London, Paris, New York or Berlin. The "long run" is therefore unknown, and the typical theatrical enterprise is the "company" which is assembled for the *Carneval,* or season, from October to Lent, and visits each of the cities with a repertory of plays. The companies of the 16th century contained about a dozen actors. Few have more than that to-day. The company tends to center around two "stars," one male, one female, who are often married, and not infrequently create a family tradition. The actor who owns and organizes the company buys the scenery for his whole repertory. The actors supply their own costumes. The better actor-managers usually win the support of one or more authors—the Duse-D'Annunzio relationship is characteristic. It is not rare for a company to be supported to some extent by a "bourgeois" who is also a patron of the leading lady. Performances themselves partake of this bohemian flavor. Careful staging and specialization of parts are all but unknown. Since the play changes nearly every night, the actors rarely memorize their lines, and the prompter, shouting from a box in front of the footlights, intones each speech some seconds in advance of the actor. If a cue is missed, the actor improvises—the tradition of the *commedia dell' arte* endures in Italy.

Most Italian cities own well-appointed municipal theaters, but such palaces are commonly devoted to opera; the actor-singer is still the aristocrat of the Italian stage. The "prose-theaters" are usually enterprises in real estate, the actor-manager bargaining with the theater owner and, for the most part, obtaining the percentage basis. Since the World War, the Italian theatrical business has shown a trend toward national organization. Certain capitalists have established chain theaters, bought up the work of successful dramatists, and retained the services of certain "stars." In this way permanent repertory theaters have arisen. On this basis, the actor's season is a little less precarious, the author's royalties are a little more secure. However, the "company" system is still far from dead; and the play as a unit enterprise, centering around a producer or director, is still unknown to Italy. These external characteristics of the Italian stage have influenced both the Italian author and the Italian actor. The play has to adapt itself to a company containing two young men and a young woman, two older people, a comedian and one or two minor characters; the actors have to be versatile, able to play all sorts of parts, and to replace one another as the vicissitudes of a season require. A. L.

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ITALIC LANGUAGE, an independent branch of the *centum*-group of the INDO-EUROPEAN linguistic family, spoken throughout the greater part of ancient Italy and, in its LATIN division, in all the Roman world, while, through ROMANCE descendants, it is the ancestor of the dominant speech of Italy, France, Spain, Portugal, Rumania, etc., in Europe, and of all the civilized peoples of Central and South America. In its ancient form, it falls into four main divisions: Latinian (Latin, Marsian, Praenestine, Faliscan, etc.), Oscan (Southern, especially Apulian; Central, including Samnite; and Northern, especially Paelignian and Marrucinian), Umbrian (*see* OSCO-UMBRIAN) and Volscian. The group is so closely connected with CELTIC and LIGURIAN that many scholars postulate an early period of Italo-Celtic unity. L. H. G.

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ITALO-TURKISH WAR, 1911-12, a war between Turkey and Italy over Tripoli in north Africa. Ambitious to secure colonies and disappointed by the French annexation of Tunis in 1881, and by the reverse at the hands of the Abyssinians in 1896, the Italians gradually returned to their conviction that a nation with a growing population should have colonies. With a view to getting possession of Tripoli, the only territory on the Mediterranean still available, she came to an agreement with France in 1902 promising to support that Power in Morocco in return for French support in Tripoli. Seven years later, in 1909, a similar agreement was made with Russia, known as the Racconigi agreement. In Sept. 1911 she sent an army to occupy Tripoli, and in November issued a decree annexing the territory, the Italian Chamber of Deputies ratifying the annexation on Feb. 23, 1912. But Turkey and the tribesmen resisted, and the war continued to Oct. 1912, when the two countries signed the Treaty of Ouchy by which Italian sovereignty in Tripoli was formally recognized.

ITALY, a kingdom in southern Europe forming a large peninsula extending into the Mediterranean Sea. Italy has not always included the whole of the present area. During the Roman commonwealth, it did not reach beyond the little rivers Macra near Luna, on one side, and Rubicon, near Ariminum, on the other.

Surface Features. Italy extends from the southeast extremity of SICILY, 36° 41′ 30″ N. lat., to the Alps, 47° N. At the north it has a Swiss frontier of 450 mi., an Austrian of 261 mi. and a Yugoslav of 152 mi. The Adriatic and Ionian seas bound it on the east and the Mediterranean on the south and west, with the exception of 303 mi. of French frontier in the northwest. The total coast line of the boot-shaped peninsula is 2,472 mi., but as Italy also comprises certain adjacent islands, there should be added the following coast line measurements: Sicily, separated from the mainland of Calabria by the Straits of Messina, 693 mi.; SARDINIA, 830 mi.; ELBA, Lipari and other islands, 973 mi., making a grand total of 4,968 mi. of coast line. In general, its natural confines may

be said to be the Alps and the seas. The breadth of the peninsula in the north is about 400 mi., but it diminishes in the center to about 150 mi. and at its narrowest point in the south, does not exceed 15 mi. The coast line is most regular on the Adriatic side, while on the west it is remarkable for the beauty of harbors and bays. Among the deepest inlets are the gulfs of Taranto, Manfredonia and Naples. The most prominent capes are Piombino, Argentaro, Circello and Campanella on the Mediterranean coast, and Spartivento and Leuca, the two southern points in the Ionian Sea.

The great mountain ranges of Italy are the Alps and Apennines. The latter are a continuance of the Maritime Alps and although not so elevated they are considered one of the important ranges of Europe. Beginning in the region of Genoa, they extend eastward to the Adriatic; running south they traverse the peninsula centrally, and continue throughout its entire length to the Straits of Messina, throwing off laterally numerous branches which form beautiful hills and slopes covered with forests, vineyards and olive groves. In the valleys there is not only wild and romantic scenery, but also an extremely fertile soil. The plain in the north between the Alps and the Apennines, stretching from the frontiers of Piedmont across Lombardy to the Adriatic, is considered the most fertile in Europe, capable of furnishing sustenance to a much larger population than are now found there. The rivers of the country are more remarkable for their number than for size. The largest of these is the Po, arising near the French frontier and flowing to the Adriatic. It receives most of the streams flowing southward from the Alps and northward from the northern slopes of the Apennines. Of the former the chief are the Dora Baltea and the Ticino, discharging the waters of Lake Maggiore; the Adda, flowing from Lake Como, and the Oglio and the Mincio, flowing from Lake Garda. Of the latter, the Strua, Tanaro, Trebbia, Secchia and the Pannaro are most important. The Adige, Brenta, Piave and Tagliamento are the principal streams flowing into the Adriatic from the Alps above the Po. The rivers of southern Italy are small, due to the narrowness of the peninsula and the division made by the Apennines, which make two watersheds, and with few exceptions are only mountain torrents. The ARNO and TIBER flow through longitudinal valleys and have each a course of about 180 mi. In Neapolitan territory the only streams worth mentioning are the Volturno, Garigliano and Ofanto. Of lakes, Italy has some of the finest in Europe, celebrated both for their size and beauty, the chief being GARDA, MAGGIORE, LUGANO, COMO and Iseo. On the southern slope of the Apennines there are the small lakes of Trasimene, Bollsena, Bracchinano, Fucino and Celano, interesting for classical associations.

Climate. The climate of Italy is both varied and excellent, enabling its population to grow the products of both the temperate and torrid zones. The atmosphere is remarkably clear, which gives to every natural object a coloring and distinction of outline seldom seen in countries to the north. In the Alps snow lies all year at an elevation of 9,500 ft. The valley of the Po has a climate resembling that of central France. In the region between 38° and 40° N. lat., snow falls only on the slopes of the mountains in the winter, and oranges, olives, lemons and citrons ripen in the open air. Farther south, snow is very rare and tropical vegetation is prolific. The mean annual temperatures for some of the principal cities are 55° F. for Milan and Venice, 59° for Florence and Naples, 60° for Rome and 63° for Palermo, Sicily. The malignity of the climate in some parts of Tuscany is practically a thing of the past, due to the scientific struggle with the pestilential marshes. The Alps, sheltering the north end of the seas which bathe both eastern and western shores, insure to-day a very healthful climate. The winters in the northern lake districts are generally mild and the summer is very agreeable even so far south as the Bay of Naples.

Mineral Resources. Italy does not compare favorably in mineral resources with other countries; except in iron and lead, as it possesses few metals. The mining industry is most developed in Sicily, especially in Caltanisetta, in Tuscany at Arezzo, Florence and Grosseto, in Sardinia at Cagliari, Sassari and Iglesias, and in Lombardy near Bergamo and Brescia. The largest number of productive mines yield iron, lead and zinc, mercury and sulphate ore. The country also produces in small quantities gold, manganese, copper, antimony, boric acid, asphaltic and bituminous substances, employing in the entire mining and mineral industry about 50,000 men, with a total annual production of 17,000,000 metric tons, valued at about 700,000,000 lire. Italy's chief mineral lack is coal. Nevertheless, in 1929 1,005,393 metric tons were produced and in 1930, 785,900 metric tons. Insufficiency of coal for power has given rise to intense development of the country's water power resources, 80% of her power in 1929 coming from this source. In 1930 Italy had 391 power stations producing 10,024 million kilowatt hours, in 1929, 9,548 million kilowatt hours.

The activity in quarrying has been productive for many years, and the 10,000 quarries, employing about 60,000 men, have given the country annually about 500,000,000 lire. The Apennines supply the beautiful Carrara stone which has made this part of Italian industry so famous.

Italy has five volcanoes, Vesuvius, near Naples, and four on the islands Etna, Stromboli, Vulcano and Vulcanello; there also are several gaseous and mineral springs. The volcanic regions, due to the decomposition of lava, have become regions of almost inexhaustible fertility. Except in the Alps and at the termination of the Apennines, granite and primitive schists occupy a very small extent of the surface. Jura limestone is largely developed in the Apennines on the eastern frontier of Tuscany, and in the Neapolitan region. It is also the prevailing rock in the northern part of Lombardy. Above the Jura limestone is a chalk formation, which with various interruptions finally reaches the extremity of the peninsula, where,

in Cape St. Maria di Leuca, its white cliffs form the eastern entrance of the Gulf of Taranto. Above all strata are immense diluvial and alluvial deposits. These are most common in the luxuriant plains of Lombardy and fill the greater part of the Po valley.

Agriculture. The natural vegetation of most of the country is not unlike that of Greece. In the north, Alpine flora gradually changes in the valley of the Po to forest and meadow, while central and southern Italy enjoys evergreen trees and shrubs. The oak flourishes at an elevation of 3,500 ft., and the walnut and chestnut at 2,500 ft. The laurel, myrtle and holly are also common, occurring often in scattered clumps. Among characteristic plants are the aloe, agave and cactus. At lower elevations, the grape and olive cover the sunny hillsides, and the mulberry, growing in luxuriance, furnishes the silk industry with its basic necessity. Fruits are grown in great variety; sugar, both cane and beet, and cotton are raised, but the principal agricultural activity is in cereals. The total forest area of the country consisted in 1929 of nearly 12,500,000 acres, about 500,000 of which belong to the state. Divided according to production, Italy's 76,637,676 acres are distributed as follows: cereals, 17,852,687 acres; vegetables, 2,346,547; vines, 2,094,249; olives, 1,426,784; and woods and forests, 12,378,723. The total agricultural land extends to 70,294,356 acres. A more detailed analysis shows that wheat occupies 11,804,643 acres; barley, 588,742; oats, 1,315,015; rye, 312,865; maize, 3,429,589; rice, 339,108; beans, 1,393,621; potatoes, 652,121; and sugar beets, 282,520 acres.

Animal Industry. In 1930 Italy had 967,406 horses, 851,504 asses, 456,538 mules, 6,901,958 cattle, 3,157,434 pigs, 9,896 sheep and 1,791,701 goats. The plains of the Po from time immemorial have fed vast herds of cattle, and the milk and cheese produced from these have been famous for many years. The fishing industry of the country is quite prosperous and is supplemented by the sponges and coral obtained off the coasts of Sicily.

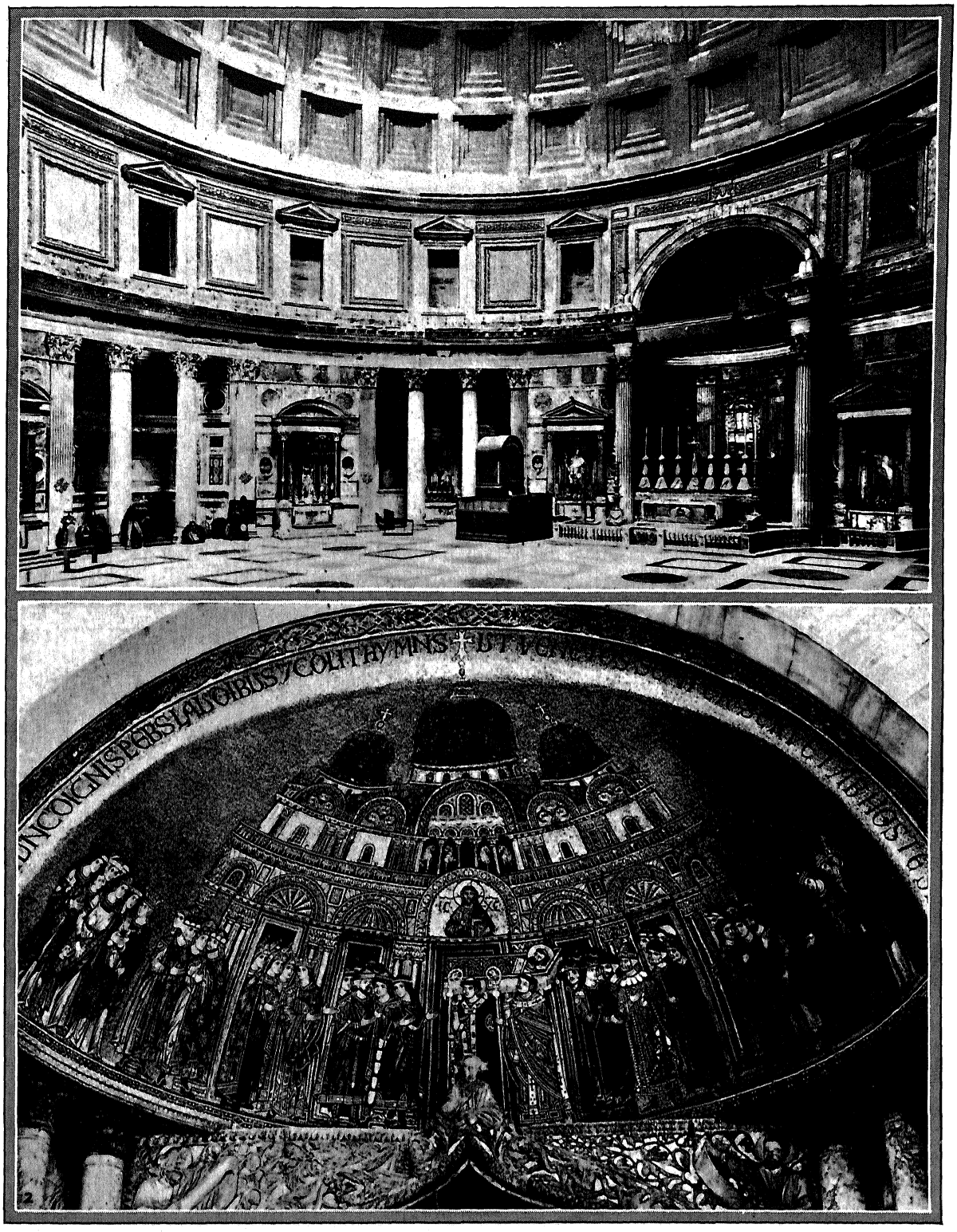
The systems of cultivation in Italy are usually divided into three, peasant proprietorship, partnership and rent. The first is most common in Piedmont and Liguria. Partnership is usually between owner and cultivator and is very general in Tuscany, the Marches, and Umbria. There are large farms in the neighborhood of Pavia, Milan, Cremona, Chioggia, Ferrara, Grosseto, Rome, Caserto and at Girgenti and Trapani in Sicily.

Manufactures. The manufactures of Italy are few in character. The industrial census of 1927 showed that there were 732,109 industrial establishments in the country employing 4,005,812 persons of whom 1,009,883 were women. The number of factories employing over 500 each were 695, those employing from 101 to 500 numbered 4,150, while 34,951 each employed from 11 to 100 persons. Indicative of the smallness of the majority of these industrial establishments is the fact that 692,313 of them employed less than ten persons each.

The cotton industry is the largest, with over 5,000,000 spindles, and 642,654 persons employed in 10,406 factories. The silk industry prevails throughout the peninsula, but is principally prosperous in Piedmont, Lombardy and Venetia, over 500,000 quintals of cocoons being produced annually. This production has increased 20% during the last five years. The manufacture of sugar increases every year and is fast becoming a major industry. From the 74,831 metric tons manufactured in 1904-05 it increased to 353,458 metric tons in 1928-29. In a similar fashion the manufacture of cheese has increased, approximately 2,500,000 quintals being made annually. Other manufactures include hats, artificial flowers, musical instruments, cotton fabrics and vegetable oils. The value of the leading imports and exports for 1929 was 21,536,299,000 lire for imports and 14,889,877,000 lire for exports, while the principal countries involved in these commercial relations were Austria, Czechoslovakia, France, Germany, Great Britain, India, Yugoslavia, Switzerland, Argentina and the United States. Imports from the United States in 1929 amounted in value to 3,560,057,000 lire; exports to the United States were valued at 1,714,092,000 lire.

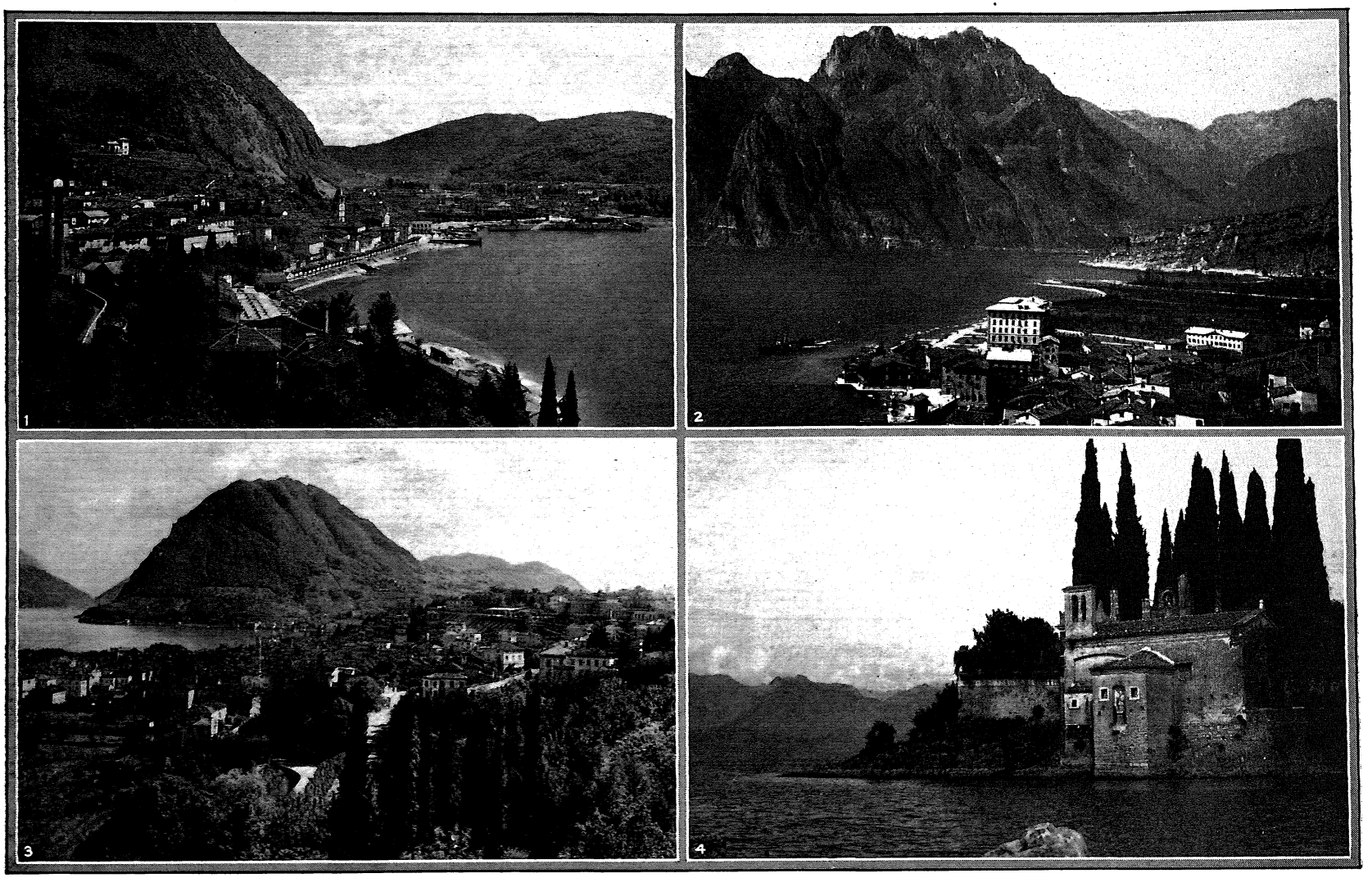
Communications. In the matter of internal communications, Italy has made great progress since its first railway was built in 1839. There are now approximately 13,600 mi. of railways, four-fifths of which are owned by the state. It is the purpose of the government to electrify 4,000 mi. of its systems, several of which have already benefitted by this power. More than 10,000 post offices handle annually about 2,250,000,000 pieces of mail, while approximately 29,000,000 private telegrams are sent inland and 2,500,000 international telegrams are wired from the country's 9,856 telegraph offices. The telephone service has about 200,000 subscribers and is made up of 826 urban systems and 3,016 interurban. Besides international conversations, these systems report a little over 20,000,000 calls a year. Twenty coast stations care for the maritime radiotelegraphic services, transmitting and receiving about 750,000 words annually. Local continental radio stations dispatch and receive nearly 1,000,000 separate messages.

Finance. Briefly, the banking and currency reports of the country indicate that in Jan. 1931 the total coinage in circulation was: silver, 1,653,142,000 lire; nickel, 448,907,864 lire; bronze, 52,308,806 lire; total, 2,136,358,670 lire. State notes totalled about 80,000,000 lire and bank notes 16,774,337,000 lire. Jan. 31, 1931, the paper currency amounted to 15,212,276,500 lire. The coinage of gold has practically ceased since 1927, when only 5,400 lire was coined, compared with 886,680 lire two years earlier. Silver coined in 1929 amounted to 237,016,000 lire. Italy has no national bank. In 1926 the *Banca d'Italia* was made the only bank of issue. There are approximately 386 joint stock banks, with deposits amounting to nearly 9,000,000,000 lire, and 430 cooperative banks with deposits of over 5,000,000,000 lire. Deposits at the beginning of 1930 were 11,777,800,000 lire in the post



THE PANTHEON AND ST. MARK'S, ITALY

1. The Pantheon at Rome, showing the beautiful interior inlaid with granite, porphyry and marble.
2. 13th century Byzantine mosaic in St. Mark's Cathedral, Venice, picturing deposition of the saint's relics.



MOUNTAINS AND RESORTS OF THE ITALIAN LAKES

1. Laveno on the shores of Lake Maggiore. **2.** Tórbole, a town on the northern end of Lake Garda. In the face of the mountain across the lake is the thin white line of the Ponale Road, hewn for the most part from the solid rock of the cliffs. **3.** Lugano on the Lake of Lugano with Monte San Salvatore in the background. **4.** Shrine on the shores of Lake Garda near Sirmione.



ITALY

Area 119,703 sq. m.
Pop. . . . 41,145,041

PRINCIPAL CITIES
(Including Figures from Latest Population Estimates)
Pop.—Thousands

40 Aderno . . . N 16
63 Alcamo . . . N 12
41 Alessandria . D 4
52 Ancona . . . F 13
56 Andria . . . J 18
18 Aquila . . . H 13
110 Bari . . . J 20
50 Barletta . . . J 18
59 Bergamo . . C 8
162 Bologna . . E 9
67 Brescia . . . D 7
31 Brindisi . . . J 22
57 Cagliari . . . L 4
31 Caltagirone . O 15
46 Caltanissetta . O 14
235 Catania . . O 16
36 Cerignola . . I 18
38 Como . . . C 5
43 Corato . . . J 19
44 Ferrara . . . E 9
65 Fermo . . . F 9
248 Firenze . . . F 9
46 Fiume . . . D 14
Florence, see Firenze.
61 Foggia . . . I 17
316 Genova (Genoa) . . E 4
214 Girgenti . . O 13
34 Lecce . . . K 22
105 Livorno (Leghorn) F 7
36 Mantova (Mantua) . D 8
114 Messina . N 17
713 Milano (Milan) . D 5
51 Modena . . . E 8
56 Modica . . . P 16
45 Molfetta . . . J 19
Naples, see Napoli.
757 Napoli (Naples) . J 14
45 Novara . . . D 4
71 Padova (Padua) . D 10
318 Palermo . . N 13
58 Parma . . . E 7
36 Pavia . . . D 5
43 Piacenza . . . E 6
52 Pisa . . . F 7
36 Pola . . . E 13
33 Ragusa . . . O 16
40 Reggio . . . E 8
45 Reggio di Calabria . N 18
656 Roma (Rome) . R 21
768 Roma (incl. suburbs) . R 21
34 Salerno . . . J 15
39 Sassari . . . G 3
32 Siena . . . G 9
40 Siracusa . . O 17
63 Spezia, La . F 6
87 Taranto . . . K 21
482 Torino . . . D 2
56 Trapani . . . N 11
229 Trieste . . . D 13
Turin, see Torino.
53 Udine . . . C 12
163 Venezia (Venice) . D 11
87 Verona . . . D 8
43 Vicenza . . . D 9
30 Vittoria . . . O 15

MALTA and GOZO

Area . . . 122 sq. m.
Pop. . . . 259,400

PRINCIPAL CITY
(Including Figures from Latest Population Estimates)
Pop.—Thousands

23 Valetta . . . Q 15

SAN MARINO

Area . . . 38 sq. m.
Pop. . . . 13,387

PRINCIPAL CITY
(Including Figures from Latest Population Estimates)
Pop.—Thousands

2 San Marino F 11

office banks and 16,459,406,000 in ordinary savings banks. The coinage of the country consisted of gold 20 lire, 50 lire and 100 lire pieces; of silver 5 lire, 10 lire and 20 lire pieces; of nickel 20 centesimi, 50 centesimi, 1 lire and 2 lire pieces; of bronze 5 and 10 centesimi pieces. The bank notes in circulation range from 50 and 100 to 500 and 1,000 lire.

Army and Navy. Service in the army and navy of Italy is both compulsory and universal, liability occurring between the ages of 20 and 55, the term normally extending for 18 months, after which the men are given unlimited leave, which means transference to the reserve until they attain the age of 55. In 1929-30 the regular army, not including the colonial units, had 16,470 officers and 235,000 men organized in 11 army corps. In Aug. 1924 there was organized the Volunteeer Militia for National Security with headquarters at Milan, Bologna, Rome and Naples. Its strength in 1930 was about 25,000 officers and 343,000 men, who are not exempt from normal service in the regular army. Peculiar to Italy are the Carabinieri, a form of military police, selected from the regular army and consisting of over a thousand officers and about 30,000 in other ranks. The Italian Royal Air Force has about 2,100 airplanes, which number is to be increased to 4,500. The force consists of 2,000 officers and 21,000 men in lower ranks. There also is an independent air force consisting of 8 regiments of 58 squadrons and 1 regiment of dirigibles. The navy in 1930 consisted of 4 battleships, 3 armored cruisers, 9 cruisers, 85 flotilla leaders and destroyers, 38 torpedo boats and 45 submarines. The navy personnel includes 2,250 officers, 34,000 men and 12,000 volunteers. The naval expenditures for 1930-31 are estimated at 1,539,966,000 lire, compared with 1,200,433,630 for the previous year.

Religion and Education. The prevailing religion of Italy is Roman Catholic and the treaty with the Holy See in 1929 confirmed this as the only religion of the State (*see* VATICAN STATE). Other forms of religious worship are allowed and all religious discussion is free. The episcopal appointments made by the pope are submitted to the government for confirmation to insure no objections of a political nature being raised. According to the census of 1931, which asked questions on religious affiliation, 95% of Italians were Catholics, 82,659 were reported as Protestants and 47,485 as Jews.

Catholic religious teaching is given in the elementary and intermediate schools. All elementary schools are free and attendance compulsory to the age of 14 years. The secondary schools are divided into complementary and technical grades, the former being slowly transformed into preparatory professional schools. The elementary schools, including the *Asili* for infants, had in 1928-29 a total of 117,023 buildings, 113,545 teachers and 4,601,574 children. In addition 2,616 private schools had 6,695 teachers and 149,587 pupils. There are 21 universities, the largest being in Naples, Rome, Bologna and Padua, this group having about 25,000 students. Commercial education is cared for in all institutes located in the principal cities with approximately 7,000 students, while six agricultural colleges have a student body of about 1,000. Eight engineering schools have an enrollment of about 3,000 students. Other special colleges provide instruction in social science, oriental studies, veterinary medicine, architecture, industrial chemistry and economic sciences.

Historical Monuments. The classic past of Italian art and civilization has given to a large number of towns and cities an interest out of proportion to their commercial importance. ROME excels all other Italian cities in its intrinsic worth and splendor, great in pagan ruins and magnificent in Christian art. The Forum, the Palatinate, the catacombs and St. Peter's make both Christian and pre-Christian history impressive. Greece also has left its mark on the landscape, so that Girgenti, Syracuse, Sellinunte, Paestum, Segesta and Taormina bear witness to the splendor attained by that ancient civilization. Thanks to the influence of the Eastern Empire, barbarian invasions did not break the tradition. Italy saw the development of BYZANTINE ART, of which the most important specimens are to be found in Ravenna, Venice, Parenzo and Rome. When this period came to a close, the Renaissance awakened Italians all over the central and northern provinces, so that to-day a description of Bologna, Florence, Genoa, Pisa, Siena, Orvieto, Pienza, San Gimignano, Perugia, Assisi, Viterbo, Volterra, Milan and many other places, is linked with the work of Michelangelo, Leonardo da Vinci, Raphael, St. Francis and the Medici, for these places have retained their palaces, churches and monuments. All descriptions of Italy become composite, for the traveller cannot insist, as elsewhere, on looking at the country with only his physical eyes; he must perforce, if he would see it in its totality employ the vision of Horace and Cicero, Dante and Petrarch, St. Francis and Savonarola, and the vision of all its rulers and leaders from the days of the Caesars down to Garibaldi, Cavour and Mussolini. *See* separate articles on these men.

Government. The government of Italy is a constitutional monarchy, the legislative authority resting with the king and parliament which consists of a senate of 439 members and a chamber of deputies of 400. The former are nominated by the king for life, the latter have a term of five years. With the Fascist revolution certain changes were introduced. The Grand Council of the Fascists, consisting of four members, decides on the lists for members of parliament. Its approval must be obtained on all constitutional questions, including the royal succession and the prerogatives of the throne. In 1930 the membership of the Fascist Party was officially given as 1,176,883. The whole country is made a single constituency, and twice as many candidates for office as are needed are nominated, from which list the Grand Council selects 400, who are proposed to the electors. If the proposed list is not approved, fresh elections are held. Each deputy is allowed a sum of 21,000 lire. The prime minister is the chief of the government and is responsi-

ble to the king, while the ministers are responsible to the king and the prime minister. Thirteen confederations of labor and capital, representing agriculture, industry, commerce, banking, transport on land and sea, air transportation and the arts and professions, constitute the bodies with power to nominate candidates. The state is divided into 92 provinces and these into 7,312 communes. At the head of each commune is a mayor appointed by royal decree, except that Rome has a governor and Naples a royal commissioner.

Population. According to the census of Apr. 21, 1931, the population for the entire kingdom was 41,230,045 for an area of 119,710 sq. mi., a ratio of 344 per square mile. The number of Italians living in other countries is estimated at 10,000,000, and nearly 20% of these are in the United States. Most of the population is homogeneous; those of foreign birth include 12,000 Germans, 12,000 Spanish, 43,000 Greeks, 80,000 French, 90,000 Albanians, 142,000 Croats and 327,000 Slovenes.

ITALY, HISTORY OF. The history of the Italian peninsula in the closing years of the Roman Empire in the West is one of barbaric invasions, civil wars, and general unrest. This period of turmoil extends from the middle of the third century to the disappearance of a Roman Emperor in the West in the year 476. At this time a band of Herulian mercenaries in the Roman army overthrew Romulus, the last Augustus of the West, and proclaimed as ruler their own leader, Odoacer. This man established a capital at Pavia and secured not only approval of his acts from Zeno, the Emperor of the Roman Empire in the East, but also received from him a commission to rule Italy with the title of patrician. This arrangement, however, was short lived, for in 488 the Emperor charged Theodoric, King of the Ostrogoths, with the administration of affairs in the Italian peninsula. War ensued between Theodoric and Odoacer and after the defeat and murder of the latter in 493 the Ostrogoths set up their sway. Theodoric did everything possible to build up a well-organized state, establishing separate systems of government for his Roman and Gothic subjects. He confiscated land for his followers; he maintained Roman institutions, including the legal system; he graced his capital, Ravenna, with beautiful buildings; and he advocated religious toleration between his Arian Goths and his orthodox Italians. The Ostrogothic Kingdom, however, failed to achieve a strong union of its two peoples and disappeared after a long series of wars, 539-53, by which Justinian, Byzantine Emperor, endeavored to reestablish the empire of the Caesars. Justinian commissioned an exarch to rule in his name at Ravenna, but this settlement lasted only a short time, for in 568 Italy was overrun anew, this time by Alboin and his barbaric Lombards. Alboin ruled over the north from his capital at Pavia and Lombard dukes over the south. Wars ensued between the invading barbarians and the armies of the BYZANTINE EMPIRE, and during them the Bishop of Rome, now beginning to assume a protectorate over the city of Rome, attained great power by playing off one power against the other.

Gregory the Great, Pope from 590 to 604, who may perhaps be considered greatest of the early Popes, succeeded in converting the Lombards from Arianism to Roman Christianity. The relations between Popes and Lombards, however, did not remain friendly for long and the Lombards sought to capture Rome. In this emergency the Pope called upon Pepin, King of the Franks, to aid him. His call was answered, and Pepin defeated the Lombard King, took from him the exarchate of Ravenna, which had just been conquered from the Byzantines, and in 756 gave it, with some other Lombard territory, to the Pope, thus establishing the temporal holdings of that Papacy. The south was not much affected by these wars and remained until the coming of the Saracens in the ninth century under the Lombard dukes of Benevento.

The Frankish-Papal alliance was continued, and in 773 CHARLEMAGNE was called to Italy to aid the Pope. The Franks were again victorious, and in 774 deposed Desiderius, the last of the Lombard kings. Charles took the iron crown of Lombardy for himself and in 800 was crowned by the Pope "Emperor of the Romans." For the time being most of Italy was part of the Carolingian Empire, in particular under those Carolingians who happened to wear the Lombard iron crown as well, but only one of them, Lewis II, 844-75, really identified himself with Italy. Their domination in Italy was, nevertheless, important because they introduced the institutions of feudalism in the territory under their jurisdiction. Charles divided up the large holdings of the Lombards among the Frankish nobility. The nobility was thus composed of soldiers, and in succeeding wars land changed hands very frequently. This condition, coupled with the fact that Charles had destroyed the holdings of the most powerful lords who might have conquered their neighbors and thus united Italy, militated against the firm establishment of feudalism, which never became a national institution, and against political centralization.

Frankish power weakened and from the fall of Charles the Fat in 887 until 951, when Otto crossed the Alps from the Germanies and assumed the imperial title, Italy was racked by internecine struggles. The authority of the Popes was at a low ebb in the center of Italy; Saracen invaders attacked Sicily; Hungarians ravaged the northern Italian plains; and the Byzantines established themselves at Bari. Otto wanted to restore order. He had himself crowned at Pavia and in 962 he renewed the empire of the West, which was henceforth known as the HOLY ROMAN EMPIRE. Thereafter the Italian crown and the imperial crown were always on the same head, a load too heavy for any one man to bear. The emperors usually devoted most of their energies to German affairs and they wasted their efforts in Italy by trying to do too much. Otto dictated the choice of Popes; he endeavored to drive the Saracens and Byzantines from their

holdings in the south; he attempted to reduce to order the Lombard Duke of Benevento; and he prevented the feudal lords from exerting their influence over the cities, thus contributing much to the power of the towns at the expense of feudalism. His policy regarding the south was unsuccessful and little change took place there until the Normans conquered Sicily, Apulia, and Calabria in the 11th and 12th centuries. This conquest was exceedingly important, because it meant the firm establishment of feudalism in these provinces and because it led later to the intervention of Spaniards and French in Italian affairs.

Nor did the Emperor's Church policy meet with eminent success. He failed to stop obviously questionable practices, and when a real reformer, Hildebrand, became Pope Gregory VII in 1073, Otto's successors fell to quarreling with the Church over matters of jurisdiction. Gregory VII wanted to establish the celibacy of the clergy, to do away with simony, the sale of Church offices, and to abolish lay investiture, a practice whereby a lay lord, in return for an oath of fealty, chose an ecclesiastical officer and conferred upon him his lands and rights. This last named abuse had permitted kings to exert considerable authority over appointments, and to play off ecclesiastical lords against lay lords, a power which the emperors were loath to surrender. A temporary settlement was reached by the CONCORDAT OF WORMS in 1122, a compromise which determined that in Germany election of bishops and abbots should be in the presence of the emperor and that their investiture should precede consecration, but that in Italy investiture and consecration should follow canonical election.

Rise of the City States. Struggles concerning such questions so occupied the emperors and popes that the cities had an opportunity to develop their independence. For the most part in the earliest centuries of the Middle Ages towns had been governed by counts and by bishops, but as economic activity in them increased, there developed an important business class which demanded a voice in government. The bishops and counts were expelled and oligarchies or republics established. Some of them followed expansionist policies and made themselves obnoxious by encroaching on the territory of their neighbors. Milan was especially detested for her actions in this respect and Frederick I, Barbarossa, of the House of Hohenstaufen, was summoned to Italy in 1154 to punish her. His desire was to restore the old Roman Empire to all its former glory and to raise himself to the power of the Caesars. His campaigns in Italy involved him in a round of troubles that not only militated against the realization of his dreams but also greatly weakened his power. The cities which he punished, especially the Lombard cities which formed the Lombard League in 1167, turned against him because of his ruthlessness; the Pope feared him for his power; and all the Italians disliked him because of his rigid administration and his heavy taxes. While he was in Italy, the Guelf party rose against him in Germany and he was forced to return to cope with it. Upon his departure from Italy his enemies there became known as Guelfs; while his supporters adopted the name of his German sympathizers, the Ghibillines—two groups who were to fight long and bitterly in the peninsula. Despite his troubles Frederick Barbarossa united the Norman kingdom of Naples and Sicily to his territory in the North of Italy by arranging a marriage between the heiress of that kingdom and his son Henry. Henry VI, emperor from 1190 to 1197, encountered many of the obstacles in Italy which his father had known, particularly the opposition of the Guelfs and of the Church, which was presided over after his death by one of the greatest of all the Popes, Innocent III. Henry's son Frederick II was not recognized as Emperor until 1212 because of rival claimants; when he did finally obtain the crown, he was more immediately interested in his Kingdom of the two Sicilies than in northern Italy or Germany. Until his death in 1250 he concentrated his remarkable gifts on administering the Sicilies and in furthering a cultural revival at his court in Palermo. After his death his son Manfred ruled in the Sicilies, but the Norman feudal lords of the kingdom and the Pope opposed him, and the latter invited a French army under Charles of Anjou, brother to the French King, to aid in capturing the Sicilies. The French accepted the proposal and were victorious, 1266-68. They remained in power until a popular revolution, the SICILIAN VESPERS, in 1282 forced them to withdraw. Then Manfred's legitimate successors, the Spanish kings of Aragon, appeared to make good their claims. In the north Frederick II's death meant that the medieval empire had practically come to an end. In the future, German Kings made no serious attempt to subdue Italy.

The almost uninterrupted wars of the 12th century which wasted the energies of those powers who might have united Italy, the emperors and popes, gave the cities of Italy further opportunity to strengthen their hold on independence. Moreover they were becoming more and more important economically. The extension of commerce over wide areas, and the partial abandonment of an effort to maintain local economic self-sufficiency, gave rise to a large class of traders who settled in the cities. VENICE and Genoa were the leaders in the most important branch of commerce, that of eastern products, a demand for which had been stimulated by the CRUSADES. They purchased their wares in eastern Mediterranean and Black Sea ports and distributed them to their neighbors to the north. Venice in the 15th century controlled the Brenner Pass, the main commercial route to Germany, and sent fleets of merchantmen to Flanders. Pisa, too, became an important trading center, while Florence became a center of textile manufacturing and banking, MILAN a leader in the metallurgical industries, and Lucca important for her silk. This business activity led to the establishment of a wealthy bourgeoisie and a salaried proletariat, both of which

demanded a voice in government, and in Venice, Florence, and Genoa republican forms of government prevailed, the upper bourgeoisie usually controlling affairs. In several other places, however, power fell into the hands of despots—the Visconti at Milan, 1277-1447, the Della Scala at Verona, 1262-1387, and the Malatesta at Rimini, 1237-1528. Naples and Milan were the only cities that dreamed of a revival of an Italian kingdom apart from the Empire, although at Rome, Cola da Rienzi restored the Roman Republic, 1347-55, and tried to command the obedience of all Italy. Wars between city states were frequent during this "Age of Despots," but they were usually fought by hired armies and were neither very cruel nor very bloody. They therefore did not prevent the amassing of great wealth or cause the dissipation of the fortunes which grew up as a result of economic activity. Capital was stored up later to be expended lavishly on the arts by captains of business like the Medici, bankers of Florence, and provided many an artist with that leisure necessary to the production of lasting work. It did much to pave the way for the attainment of great heights in painting, sculpture, philology, and letters in the period which is commonly known as the RENAISSANCE.

Period of the Renaissance. In the years 1494-1559 the French once more tried to conquer Naples, but this time they had designs on Milan as well, and tried to take it by force, since the Emperor, its overlord, preferred to recognize Ludovico Sforza as duke. Louis XII, King of France, failed to hold Naples, from which he was ousted by Ferdinand of Aragon, in 1504. He held Milan for a time, 1500-12, as did his successor Francis I, 1515-25, but Francis actually enforced with more success a third claim, that to Piedmont, which he occupied in spite of its sovereign, the Duke of Savoy, and which he and his successors used as a military base for fruitless efforts to recover Milan and Naples, 1536-59. The chief reason for the ultimate failure of France was the unbeatable combination of her Spanish and Austrian opponents, whom a marriage alliance had united. In 1530, Emperor Charles V, heir of both houses, received the crown of Naples from Pope Clement VII, who could refuse him nothing after the sack of Rome in 1527. In 1535, on the death of the last of the Sforza, Charles made Milan one of the family possessions, giving it to his son Philip of Habsburg, afterwards Philip II of Spain, and he and his followers dictated policies in the Duchy of Tuscany and other small dukedoms. The French gave up all claims in Italy by the treaty of Cateau-Cambresis in 1559, but any sign of weakening of Spanish authority thereafter brought a new French invasion of Italy, the last one being in 1647. Thus Charles V and his son Philip II, to whom was given the Italian possessions, became masters throughout the entire peninsula with the exception of Venice, Savoy, Genoa, and the Papal States. Before the union of Austrian and Spanish interests, the Popes usually opposed France, and twice formed coalitions against her,—League of Venice, 1494; Holy League, 1511. In the contest between the French and the Austro-Spanish power, the Popes were generally on the side of France, and twice engineered leagues of the Italian powers against the common enemy,—League of Cognac, 1526-29; League of 1557 against Philip II. These wars took place at a time when a far greater calamity was befalling Italy than the mere conquest of the peninsula by foreigners. With the Portuguese discovery of an all water route to India, the subsequent exploitation of that route by Portuguese traders, and the establishment of a Portuguese monopoly over trade with the east, the Venetians and Genoese discovered that they could no longer purchase eastern products in the Near East, because the people there had none to sell. When the Italians became aware of the predicament in which they were placed, they aided the Turks in fighting the Portuguese, but all to no avail. They were forced to accept the new turn of events and remained powerless, while the center of commerce shifted from the Mediterranean to the Atlantic seaboard, a change that meant the doom of the economic supremacy of the Italian peninsula.

Decay and Foreign Dominion. This relative decline of the economic position of Italy and the weakening of the Catholic Church by the Protestant revolt was accompanied by a falling off of the political significance. Nevertheless, she was still fought over and France tried to secure the western passes of the Alps by marriages between the dukes of Savoy and French princesses and by piecemeal annexation of Savoy in the interests of the "natural boundaries of France." Henry IV betrayed designs on Tuscany by marrying Marie de Medici in 1600, and Richelieu exerted himself to place a French duke on the throne of Mantua. Furthermore, when the Spanish Hapsburg line ran out, France challenged the Austrian Hapsburgs to a duel—the WAR OF THE SPANISH SUCCESSION—for the plums that were to be plucked in Italy, Spain, and America by the victor. By the TREATY OF UTRECHT in 1713 Naples, Sardinia, and Milan were transferred to Austria, the beginning of that nation's hold on Italy; and Savoy, which was to be raised to the rank of a kingdom, was given Sicily. By the Treaty of London in 1720 Austria and Savoy exchanged Sardinia and Sicily and following the War of Polish Succession in 1738 Tuscany was assigned to Francis of Lorraine, husband of Maria Theresa of Austria. In 1768, CORSICA was finally annexed by France, to whom she had long been accustomed to look for aid in her conflict with Genoa. The Corsican patriot Pasquale Paoli (1725-1807) vainly headed a revolt against France, as he had previously headed a revolt against Genoa. This was the fourth and most permanent annexation by France of Italian territory. Savoy and Nice, in 1859, were to be the last.

The Italian rulers were deeply affected by the events of the French Revolution. The wife of the King of Sardinia was a sister of Louis XVI, and the three Austrian rulers, or prospective rulers, of Italian states were brothers of Marie Antoinette, while the

King of Naples was her brother-in-law. The occupation of Savoy and Nice, possessions of the King of Sardinia, was one of the first evidences of the rally of French national spirit under the Convention, Sept. 1792. The Italian states joined the first coalition against France which followed the execution of Louis XVI. With the accession to power of the Directory in France, the Italian monarchies were doomed. The French general, Napoleon Bonaparte, who was of Italian extraction and had barely missed being born a subject of Genoa, began their transformation at the termination of his first Italian campaign, Apr. 1796 to Apr. 1797. He converted the Duchy of Milan into the Cisalpine Republic, the Republic of Genoa into the Ligurian Republic, the Papal States into the Roman Republic; and the Kingdom of the Two Sicilies into the Parthenopean Republic. He destroyed the Venetian Republic, giving its territory to Austria, and took control of Tuscany and the small duchies of central Italy. The republics which he set up were only temporary structures; later he placed his brother Joseph on the throne of the Kingdom of the Two Sicilies, transformed the Cisalpine Republic into the Kingdom of Italy, of which he made himself the King, annexed Piedmont, Tuscany and the Ligurian Republic to France, and virtually took over the Papal states. Upon Napoleon's defeat these Italian states crumpled like block-houses. The Treaty of Vienna, 1815, placed Venice and Milan in the hands of the Hapsburgs, restored the King of Sardinia to his throne and gave him Genoa, returned the Kingdom of the Two Sicilies to the Spanish Bourbons, and restored the power of the Pope in the Papal States.

Era of Unification. The Napoleonic period was less significant for the kaleidoscopic political changes that took place than for the impetus that was given to the idea of Italian unification, Italian nationalism, and constitutional government. The period between the Restoration of 1815 and the attainment of Italian unity is known as the Risorgimento—the "resurrection." It was not a resurrection, but birth, and it owed much to the contemporary romantic writers, such as Manzoni, and d'Azeglio. They encouraged agitation for the expulsion of the foreign princes and their followers were influential in establishing the *Carbonari,* a secret society, whose leaders directed the unsuccessful insurrections at Naples, July, 1820 to Mar., 1821, and at Turin, Mar. and Apr., 1821. The July Revolution at Paris in 1830 was the occasion for a second effort of the *Carbonari,* who had been active in the Papal States during the misgovernment of Leo XII, 1823-29. It was directed by a central revolutionary committee at Paris and broke out at Modena, Bologna, and Parma in Feb., 1831, where, for the first time, there was a shade of popular interest in the enterprise. As in 1820-21 Austrian forces intervened to restore order and there followed fierce retaliation. When the Papal government supported by Austria proved deaf to the demands for reform, Louis Philippe dispatched French troops to occupy Ancona, 1832-38, by way of protest. Louis Napoleon Bonaparte and his brother participated in this insurrection. The organization by Giuseppe Mazzini (1805-1872) of the *Giovane Italia* or "Young Italy" society marks a step forward by elevating Italian nationalism into a philosophy. Mazzini believed in preparing the youth of Italy for the place which they must fill when, as he deemed inevitable, the soil of Italy should be free of her foreign rulers. His fiery earnestness won for this new secret organization adherents in many lands, but he had not the genius nor the patience for leadership. More constructive leaders took his place, and he devoted his later years to the international socialist movement.

The agitation for Italian independence now took on a more statesmanlike character. Of treatises looking to the solution by creating a federated state are to be cited the *Primato morale e civile degli Italiani,* 1843, of Vincenzo Gioberti, the *Speranze d'Italia,* 1844, of Cesare Balbo, and the *Casi di Romagna,* 1846, of Massimo d'Azeglio. Gioberti desired the unification of Italy under the Pope, while Balbo and d'Azeglio, who denounced the Papal government uncompromisingly, believed that the King of Sardinia was the only leader who could effect the desired end. The best governed state in Italy was Tuscany, where there was no censorship of the press and where political exiles were tolerated, but its ruler was an Austrian archduke, and the only states ruled by Italians were Rome and Sardinia. The King of Sardinia, Charles Albert, 1831-49, had lived as a child in revolutionary Paris, had taken part in the revolt at Turin in 1821, and had never quite joined the reaction, even when he became king. The accession at Rome of Pope Pius IX, 1846-78, inspired hopes of better things. Again a revolution at Paris gave impetus to new insurrections, but the movements of 1848 were already in progress at Milan, Naples, and Palermo, and a constitution had been granted by Leopold of Tuscany before the February revolution. Charles Albert also granted one, Mar. 4, 1848, and one was wrested from the Pope. In the Austrian dependencies, revolutionary governments were set up on th fall of Metternich (notably the Venetian republic by Manin). The Italian states which now joined in an attack on Austria abandoned the war when Charles Albert was defeated at Custozza, July 1848; and it was a forlorn hope when, counting on the Hungarian revolt, he renewed the struggle only to be worsted again at Novaro, Mar. 1849. As Pius IX, restored by troops dispatched by the new French President, Louis Napoleon, definitely identified himself with the reaction, Sardinia became the hope of every patriot.

Kingdom of Italy. The new King of Sardinia, Victor Emmanuel II, justified that hope with the help of Camillo Cavour (1810-1861), editor since 1847 of the *Risorgimento,* and premier since 1852 of Sardinia. He sought the help of the avowed champion of nationalities, Napoleon III, and Sardinia became a member of the alliance against Russia in the Crimean war. At the peace conference in Paris fol-

lowing that war, Cavour presented his plan for the settlement of Italian grievances by the powers. He prevailed upon the French Emperor to aid him in an attack on Austria, and this time the fortunes of war made France and Sardinia victors on the fields of Magenta, June 4, and Solferino, June 24, 1859. In the midst of the campaign, and before the Austrians had been driven out of Venetia, Napoleon III made a separate peace with Austria, much to the disgust of Cavour. Moreover, Napoleon insisted that Cavour surrender Nice and Savoy to him for his services, which Cavour consented to do when Napoleon extended permission to Sardinia to annex territory to the south. The rest of the peninsula, except the city of Rome, which was defended by the troops of Napoleon, joined the promising nucleus of an Italian kingdom partly by plebiscite and partly by acceptance of the conquests of GIUSEPPE GARIBALDI in the south.

The first Italian parliament was opened in Turin, Feb. 18, 1861; the Italian constitution was that of Sardinia, which had been granted by Charles Albert. When the French troops retired from Rome in accordance with the September Convention of 1864, Victor Emmanuel accepted the removal of the capital to Florence as a visible sign of the renunciation of Rome. But public opinion insisted on Rome as the capital, and Garibaldi continued to plan attacks on the Eternal City. One such attempt was followed in 1867 by the return of the French troops.

Once again Victor Emmanuel allied himself with a great power. In the SEVEN WEEKS WAR in 1866 he sided with Prussia against Austria and as a result Italy received Venice. A third time she profited by a war, for, when France recalled her forces from Rome to confront Prussia in 1870, the troops of Victor Emmanuel entered Rome on Sept. 20, 1870. The Law of Papal Guarantees, May 13, 1871, regulated the status of the Papacy in the ensuing years of passive resistance to the Kingdom. Rome was henceforth the capital.

In the Chamber of Deputies, the party of the Right, that of the colleagues of Cavour and Victor Emmanuel, lost its majority in 1876 with the fall of the Minghetti cabinet. The victory of the Left, representing the southern liberated provinces, signified new departures in policy. The new leaders embarked on an ambitious overseas program, far transcending the resources of the new state, hampered as it was by a crushing national debt and a depreciated paper currency. Parties ceased to be well defined, and from the time of premier Depretis, 1876-87, the attainment of temporary coalitions by a minister in support of his policies was resorted to. In 1882 the franchise were reformed by the lowering of the property qualification and the age limit. Universal suffrage was granted in 1912 and proportional representation in 1920.

Expansion and Social Problems. Depretis, and after him Crispi, 1887-91, 1893-96, resumed the old enterprises of the Kings of Naples in northern Africa. Thwarted in her earliest objective by the French seizure of Tunis in 1881, Italy joined Germany and Austria in the TRIPLE ALLIANCE, and immediately secured the consent of her new allies to the annexation of Tripoli. Even France, which had snatched Tunis from her, was complaisant toward her annexation of Tripoli when she received Italy's assurance that her alliance with Germany portended no ill whatever to France. On the Red Sea coast, the nucleus of Italian possessions was a foothold acquired by an Italian navigation company immediately after the opening of the Suez Canal. Massawa was occupied in 1885 to aid England in the expedition to the Sudan. Eritrea grew out of concessions obtained from Abyssinia, and Italian Somaliland from treaties with Arab chiefs. But the contemplated protectorate over Abyssinia was shattered by the diplomatic and military skill of Menelik II and an Italian defeat at Adowa, Mar. 1, 1896. Thereafter Italy concentrated on Tripoli and took advantage of the revolution of 1908 at Constantinople to complete by conquest in 1911-12 her peaceful penetration of many years.

The first signs of a new political party of importance appeared with the growth of Socialism. It dated from the penetration of German capital and the development of factories in the cities of the north. Crispi attempted to suppress the Socialist unions headed by Filippo Turati, editor of *La Critica Sociale,* but all in vain. Actually, Socialism in Italy all but succumbed during the strikes of 1903-04, discredited as it was by its association with anarchism after the assassination of King Humbert, 1878-1900, at Monza. The labor unions which it sought to organize identified themselves with the improvement of living and working conditions, collective bargaining, and workmen's insurance. The World War galvanized the Socialists in Italy as elsewhere into activity against governments which could be pushed into war by the military element.

Italy entered the war in accordance with the Pact of London, May 1915. Her object was to win what remained of "unredeemed" Italy, especially Trent and Trieste, and Trent implied the Italian Tyrol, the possession of which by an alien power exposed Italy to invasion through passes in the Alps. These were the "doors" which General Cadorna had to "lock" in the winter of 1915-16. Trieste implied the peninsula of Istria, which, together with Dalmatia, but not including the city of Trieste, had belonged at one time to Venice. The hard-won victories of Italy on the Carso and the Grappa were all but rendered vain when, in Sept. 1917, peace propaganda contributed to the disastrous reverse at Caporetto. Until 1918 every effort was devoted to holding the line of the Piave. In the summer of that year they again assumed the offensive and drove the Austrians out, penetrating deep into enemy territory by November.

The Treaty of Versailles accorded Italy Trent and Trieste, leaving unsettled the thorny question of Fiume and the Dalmatian ports. Fiume was occupied by GABRIELE D'ANNUNZIO, distinguished aviator as well as writer, in Sept. 1919, and was held by him

until he was dislodged by General Caviglia at Christmas time. Protracted negotiations gave Zara to Italy, but made Fiume a free city, except the Croat suburb Sushak, which went to Jugoslavia by the treaty of Rapallo, Nov. 12, 1920. The occupation of Fiume by Fascisti in Mar., 1922, reopened the question, and the treaty between Italy and Jugoslavia of Jan. 27, 1924 recognized the sovereignty of Italy over Fiume.

Fascism. Fascism dates officially from the organization at Milan in Mar. 1919 of the first *Fascio*. Its chief was Benito Mussolini, editor of the *Popolo d'Italia,* which he founded when he broke with Socialism in 1914. During the war he became ardently nationalist and irredentist and sustained D'Annunzio in the effort to annex Fiume. Fascism's mission was nationalist and it gathered to its fold nationalist bourgeois and proletarian elements. When Socialists with an internationalist bent seized factories in Aug., 1920, Premier Giolitti, who had held office in 1892-93, 1903-5, 1906-9, 1911-14, and 1920-21, consented to a joint control by boards of employers and employed. The radical Socialists, who had seceded from the Party at the Congress of Livorno in Jan. 1921, launched a program of strikes, and in Mar. 1921 bombed the Diana theatre in Milan with fearful loss of life. The Fascisti led the counter-revolution in the name of a Greater Italy. They sent members to the chamber of Deputies by getting the support of the Nationalist Party in 1921. In July, 1922, when the Socialists announced a general strike, the Fascists served notice on the government to act effectively. When it failed to do so, they marched on Rome, Oct., 1922, where on Oct. 30, the leader, Benito Mussolini, was entrusted by King Victor Emmanuel with the government.

The years of Fascist dictatorship must be associated with financial reforms, stabilization of the *lira* and balancing of the budget, improvement of the railways, and control of labor and capital by means of the corporate state. In the field of diplomacy, besides the treaty with Jugoslavia, its greatest achievement was the Concordat of Feb., 1929 with the Church, by which the Vatican was made an independent state, and the Pope was indemnified for the former loss of his territory. Since the signing of that accord, friction has developed between Church and State over the question of training the youth and the alleged political activity of Catholic clubs. As regards the first problem it should be noted that both Church and State desire to win the major interests of the children, ambitions which cannot be settled easily by any paper agreement. As regards the second question, Fascism declares itself a political monopoly and will brook no opposition. In 1931 the incipient *Kulturkampf* was dealt with by the negotiation of a *modus vivendi* which led to at least temporary peace between the two rivals for the first place in the hearts of the Italian people.

S. B. C.; F. C. C.

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ITASCA LAKE, a small lake in north central Minnesota lying south of Lower Red Lake and west of Leech Lake. It consists of three long, narrow arms and is the source of the Mississippi which starts on its 2,555-mile course to the Gulf of Mexico from the northernmost arm of the lake. An area of 32,000 acres including the lake and immediately surrounding territory, largely in Clearwater Co., has been purchased by the state and is called Itasca State Park. Many kinds of fish inhabit the waters of the lake; beavers are abundant and a herd of elk has been established. The park is accessible by improved motor roads.

ITCHING. *See* Pruritis.

ITCH MITE, the common name for a parasitic mite (*Sarcoptes scabiei*) which causes a skin disease known as scabies, mange or the itch in man and other mammals. The creature is very small; only the female, which is much larger than the male, can be seen without a microscope. Generations of itch mites may go through their life cycles on one host. The females make burrows for their eggs in the skin, but the males remain on the surface.

As the majority of mankind has learned to pay some attention to the elementary rules of hygiene, the itch has become a much less common disease than it was formerly. The presence of the parasites causes severe itching and the skin becomes scaly. Sulphur is used to kill the mites, and soothing ointment applied to relieve itching. The mites which infest animals like dogs, horses and sheep are all thought to be varieties of the same species as that which causes the itch in man.

ITHACA, or **ITHAKI,** of the seven Ionian Islands, is 5th in size and belongs to Greece. The island, which is celebrated in Homer's *Odyssey* as the kingdom of Ulysses, is 12 mi. long and has an area of 45 sq. mi. It is divided by the Gulf of Molo into two parts, both mountainous, the northern part capped by Mt. Anoi, 2,650 ft., and the southern part by Mt. Stephanos, 2,100 ft. Vathy, the principal town and a port on the Gulf of Vathy, has a population of 4,000. The island comprises four districts, called Vathy, Aeto, Anoge and Exoge. The chief products are grapes, olives and currants, and there are several coral and sponge fisheries. The island does not fulfill Homer's description of ancient Ithaca, which is identified by some archaeologists with Leucas. Est. pop. 1931, 12,000.

ITHACA, a city of south central New York, the county seat of Tompkins Co., situated at the southern end of Cayuga Lake, about 60 mi. south of Syracuse. It is served by bus lines, canal boats and the Lehigh Valley and the Delaware, Lackawanna and Western railroads. The manufactures include firearms, adding machines, typewriters, electric clocks,

signs and tissue paper. In 1929 the factory output was worth $8,757,096. Ithaca is a market for farm products and coal. Located in the heart of the scenic Finger Lakes region, the city is a favorite summer resort. Fine roads radiate in every direction, and small streams, descending from the hills through deep gorges, are a picturesque feature. Ithaca is best known as an educational center, being the seat of Cornell University, and also the New York State College of Agriculture and Veterinary Surgery, the Ithaca Conservatory of Music, and affiliated schools, now known as Ithaca College. The first permanent settlement was made here about 1789. Ithaca was chartered as a city in 1888. Pop. 1920, 17,004; 1930, 20,708.

ITO, HIROBUMI, PRINCE (1841-1909), Japanese statesman, was born as a commoner at Tsukari, Sept. 2, 1841. Like his friend Marquis Inouye he was a retainer of the Lord of Choshu and with the assistance of the latter went with Inouye to England in 1861, an act then strictly forbidden by Japanese laws. On his return he preached the vital need of westernizing Japan if she were to remain an independent nation facing Europe and America. He became one of the most prominent members of the reform party, acted as first ministerial Premier of Japan in 1886, sat in the reform ministry of 1889 and was chiefly responsible for the parliamentary constitution of 1890. He gradually became the chief advisor of the Emperor Meiji (*see* MEIJI TENNO) through whom he worked incessantly to westernize and strengthen Japan. He was appointed first Japanese Resident-general of Korea and had resigned from that position shortly before his assassination by a Korean at Harbin, China, Oct. 26, 1909.

ITURBIDE, AUGUSTIN DE (1783-1824), Mexican soldier and Emperor of Mexico, 1822-23. When, in 1820, the liberal measures of the Spanish Cortes aroused the opposition of clericals in Mexico, Iturbide espoused their cause. He received an army from the viceroy on the pretext of stamping out the desultory independence movement, and then made a pact, known as the Plan of Iguala, with the leader of the revolutionists, Vicente Guerrero. This pact declared Mexico independent, and promised a monarchical form of government and full protection to the clergy (Feb. 24, 1821). Iturbide was crowned emperor July 25, 1822, and ruled until his harsh, despotic measures made his resignation necessary, Feb. 19, 1823. He retired to Italy after his enforced abdication, but in July 1824, attempted to return and was seized and executed.

IULUS, JULUS or **ASCANIUS,** in Virgil's AENEID, the son of AENEAS and CREUSA, and the father of Silvius. He accompanied Aeneas on the long voyage from Troy to Italy, and is remembered chiefly for having killed, through the contrivance of JUNO, the pet stag of Silvia, daughter of the herdsman Tyrrheus. He at last founded Alba Longa, the birthplace of ROMULUS and REMUS, and became the traditional founder of the great Julian line of Romans.

IUS CIVILE, in earliest times, the law of the Roman city; in the classical period, that resulting from legislation or interpretation by the jurisconsults. It is opposed to IUS GENTIUM as it is applicable only within a state, on both public and private matters.

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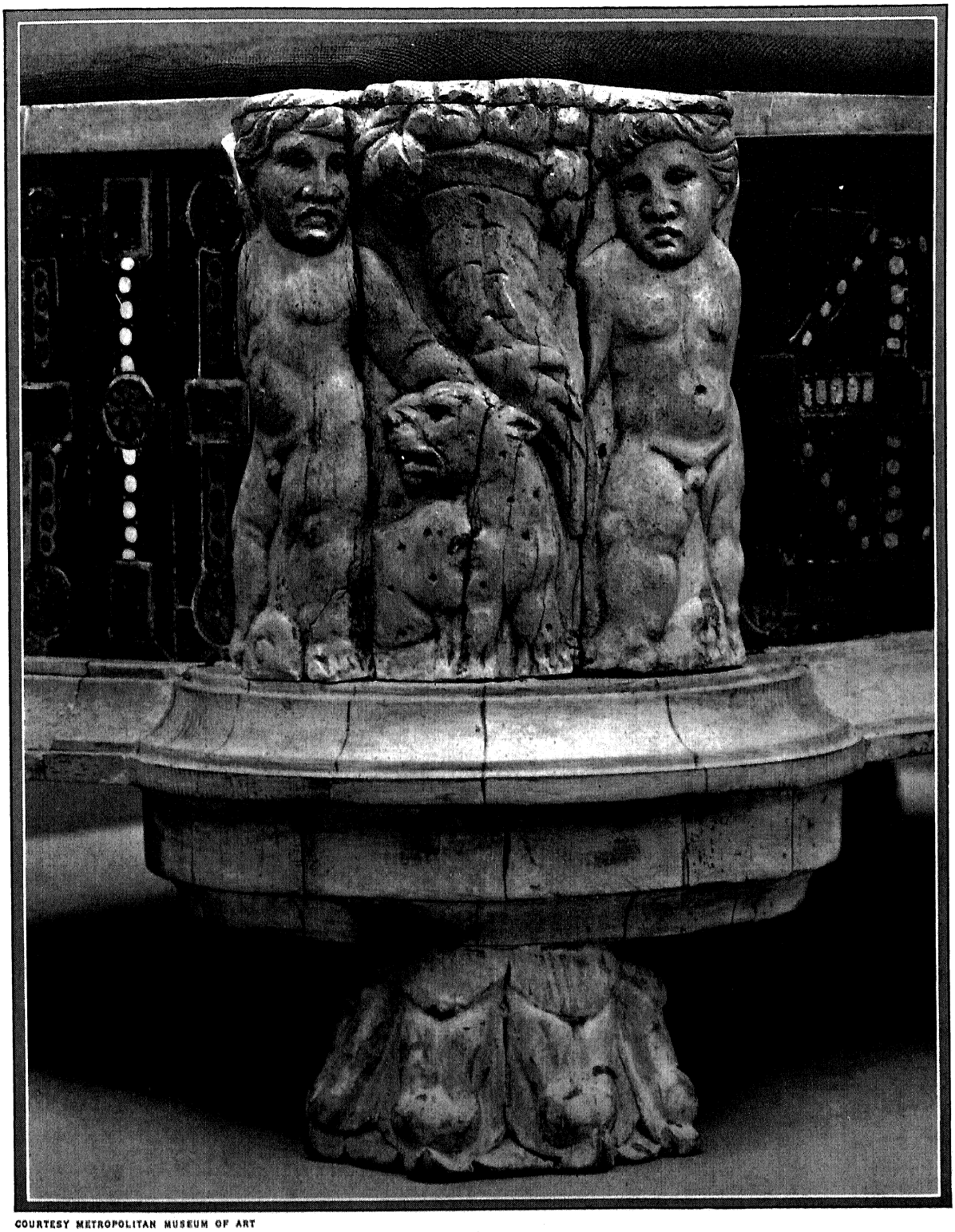
IUS GENTIUM, in the classical sense, the collections of statutes—customs of the Mediterranean people—to which a foreigner in Rome could refer. It early developed as an aid to commercial relations and became an important element in late Roman law. In public law, it is the body of principles applicable to relations between nations; and so synonymous with International Law.

IVAN, name of several Russian grand princes and CZARS. IVAN I (? -1341) was the first Prince of Vladimir, Novgorod and Moscow, and was made Grand Prince of Moscow by the Tartars in 1328. An able and successful ruler, he died in 1341. IVAN II (1326-1359), son of Ivan I, succeeded his brother in 1353. His rule was weak and incompetent, with the clergy of the established church as his principal advisers. IVAN III (1440-1505). IVAN IV (1530-1584).

IVAN IV (1530-84), surnamed "The Terrible," Czar of Russia, was born Aug 25, 1530. In 1533 after his father died he became grand duke of Muscovy and assumed control of the government in 1544. He was crowned as the first Tsar of Russia on Jan. 16, 1547, soon after marrying Anastasia Zakharina-Koshkina, of the family later known as Romanov. In 1552 he took Kazan and two years later Astrakan from the Tartars, and in 1584 conquered Western Siberia. Ivan did much for the commercial advancement of Russia but was an unbalanced and dissolute man capable of atrocious cruelty. He died Mar. 18, 1584.

IVAN THE GREAT (1440-1505), known also as Ivan III, Czar of Russia, was born in 1440. He succeeded his father as Grand Duke of Muscovy in 1462, gradually obtaining additional territory, until 1480, when he was strong enough to become free from Tatar control. This gave him increased prestige, and control over more territory. Ivan encouraged industry and commerce with other countries He died in 1505.

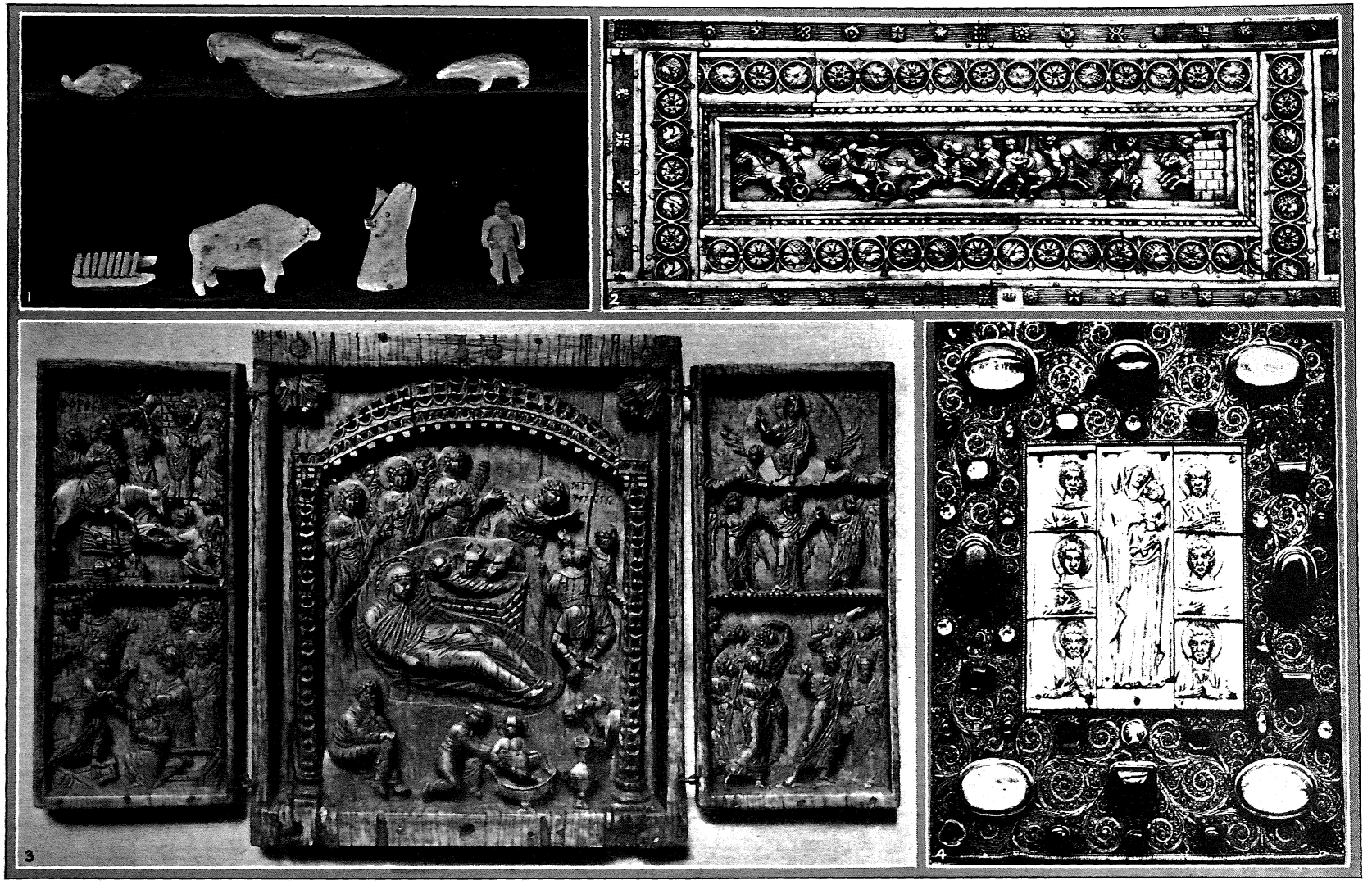
IVANHOE, a historical novel by SIR WALTER SCOTT; published 1819. The scene is set chiefly in Yorkshire and Leicestershire in about 1194. Amidst all the pomp of chivalry, the hero, Wilfred of Ivanhoe, a young Saxon knight, pursues his numerous romantic adventures—most notably at the tournament at Ashby-de-la-Zouch, at the siege of Front-de-Boeuf's castle, and in his final encounter with the villainous Templar, Brian de Bois-Gilbert, when he saves the life of a noble Jewess, Rebecca. Among the minor characters of importance are Richard, Coeur de Lion, just returned from his Crusade; Robin Hood, Friar Tuck and Allan-a-Dale; the comic domestics, Gurth and Wamba; and the pale Lady Rowena, whose love Ivanhoe wins at last.



COURTESY METROPOLITAN MUSEUM OF ART

IVORY CARVING OF THE FIRST CENTURY

Detail of an early Roman stool with ivory carvings.



1, COURTESY AMERICAN MUSEUM OF NATURAL HISTORY; 2, 3, 4, METROPOLITAN MUSEUM OF ART

THE ART OF IVORY CARVING

1. Objects carved by the Eskimos of North America from walrus ivory. **2.** Coffer top of ivory showing combat scene in Hippodrome at Constantinople. Byzantine, 9th century. **3.** 11th century carved ivory triptych of the Assumption of the Virgin and life of Christ. **4.** Carved ivory book cover in metal frame. Byzantine, 12th century.

IVAN IVANOVITCH, a national nickname for the Russian people. It originated in the fact that many peasants or *muzhiks* were called by this name, and the term was used at first in a deprecating or derisive sense. It is comparable to "Uncle Sam," "John Bull," "Cousin Michael" and "Jean Crapaud." *Ivan Ivanovitch* is also a poem by ROBERT BROWNING.

IVANOVO-VOZNESENSK, the administrative center of the Ivanovo industrial area of the R.S.F.S.R., situated about 200 mi. northwest of Moscow, and called the "Russian Manchester." The small river Ugoda separates the city into two parts: Ivanovo, dating from the 14th century, and Voznesensk, from the 18th, the two being united in 1872. Cloth manufacturing is the city's foremost industry; one-third of all cotton goods produced in the Soviet Union comes from here. Linen and cloth-printing factories have existed in the city since the middle of the 18th century. Its industrial character made it a center in pre-war days for strikes and revolutionary activities. To-day it is a modern city, with a constantly increasing population. The community, with excellent railroad connections, is also a trading-point, and has iron and chemical works. The most noteworthy buildings are the Provincial Museum, the Polytechnic Institute and the Pokrovsky Cathedral. Pop. 1931, 162,300.

IVIZA, a Spanish island of the Mediterranean, and the third largest of the BALEARIC ISLANDS, lying 70 mi. southwest of Majorca. The island has a length of about 20 mi., a breadth of 13 mi. and an area of 230 sq. mi. The island has tree-covered hills, the highest point of land being Pico de Atayasa. Fruits, particularly figs and pears, and almonds, are the principal products. Flax, hemp and corn are raised, and lead and salt are the main mineral products. Iviza, located on the southeast coast, is the capital and largest town. Est. pop. 1929, 24,000.

IVORY, a hard, creamy-white substance which composes the tusks of elephants; also the substance comprising the tusks of other mammals. The chief source of ivory is the African elephant from which the largest tusks are obtained. Other large supplies are obtained from the fossil remains of prehistoric animals.

Ivory is used in the manufacture of many products. Because of its high elasticity it is ideal for billiard balls. Because of its ability to take a high polish, it is used extensively for ornamental objects. The charred chips of ivory working are used in the manufacture of IVORY BLACK, an intense black paint pigment. *See also* IVORY CARVING.

IVORY BLACK, a rare pigment used in the manufacture of intense coach colors. It is made by digesting charred ivory chips in hydrochloric acid until almost all of the calcium phosphate is dissolved. Being colloidal (*see* COLLOIDS) in nature, it has intense staining power. Ivory black is used in varnish and high grade black enamels. It contains about 10 or 12 per cent of carbon, to which it owes its color, three or four per cent carbonate and the remainder phosphate of lime.

IVORY CARVING. In the field of art, ivory includes not only the material from the elephant's tusks, but also similar material from the walrus, hippopotamus and mammoth, and certain other kinds of bone and horn. Ivory carving is one of the oldest of arts, and its products are among the most permanent. Examples exist in our museums of Egyptian ivory carvings back to the 3rd century B.C., and others far older, representing the Paleolithic age, at least 25,000 years ago, many surprisingly artistic. Skillful and elaborate work, from the 16th century B.C. on, has been found in Crete, Cyprus, Syria, Asia Minor, Nineveh, Greece, Italy and Spain. The Greeks used ivory in their colossal chryselephantine statues to represent the flesh and gold for the clothing. In ancient and also in medieval times, the artists often colored and gilded their ivory carvings and sometimes embellished them with jewels. After the Christian Era, the carved ivory tablets used by Roman consuls for official messages were transformed into covers for missals and reliquaries; and ivory was the favorite material for ecclesiastical art during some centuries.

India is thought to have originated ivory carving. Many exquisite examples have come also from the Orient. The North American Eskimos have decorated their everyday articles of bone and ivory with skillful carving and engraving for at least 1,000 years.

IVORY COAST, part of the Gulf of Guinea coast in French West Africa which stretches inland between Liberia and the Gold Coast. Area 121,590 sq. mi.; numerous though often unnavigable rivers flow southward from the highlands. The western section of the coast is rocky. The most valuable exports of the forest zone are mahogany, palm-oil and palm kernels; and cocoa shipments increased from one ton in 1901 to more than 6,000 tons in 1928. Although the labor problem presents difficulties, a great deal is being done to increase the production of coffee, copra, kapok and cotton.

The administrative center is Bingerville (the name commemorates a famous French explorer), situated on a lagoon at the entrance of which is the chief port, Grand Bassam. Assinie and Laku are other ports to be noted. The railroad runs northward from Abidjan to Bwake and Katiola, and in 1931 was extended into the Kong country. Pop. 1,724,545.

IVRY, BATTLE OF, 1590, an engagement between Huguenots under Henry IV of France and Catholics led by the Duke of Mayenne. On Mar. 14 the armies of Mayenne met the Royal squadrons drawn up for battle on the plain of Ivry on the Eure. The battle lasted several hours. Mayenne's forces were routed and most of the foreign mercenaries killed. This victory vastly increased Henry's prestige.

IVRY-SUR-SEINE, an industrial suburb of Paris in the department of the Seine, topped by the Fort of Ivry. The city has oil and engineering works and manufactures organs, electric lamps, and earthenware. Pop. 1931, 48,929.

IVY (*Hedera Helix*), a root-climbing, evergreen vine of the aralia family, native to Europe and Asia,

widely cultivated to cover walls and also grown as an indoor ornamental. The usually smooth stems, either creeping or climbing high, produce abundant, highly variable foliage. The stiffish, leathery, mostly 3 to 5-lobed leaves vary in outline from triangular to kidney-shaped. On the fruiting branches are borne numerous greenish flowers clustered in umbels and small black berries. Various other wall covering vines are called ivy, as the Boston-ivy (*Parthenocissus tricuspidata*), the German-ivy (*Senecio mikanioides*) and the Kenilworth-ivy (*Cymbalaria muralis*).

IXION, a mythical Greek divinity, king of the prehistoric Lapithae. When Deïoneus, father of his wife, demanded bridal gifts that had been promised, Ixion, at a banquet, treacherously caused him to fall into a pit of fire. The gods were indignant, but ZEUS took pity on Ixion, purified him and invited him to the Olympian table. Ixion thereupon made love to HERA and Zeus created a phantom of that goddess by whom Ixion became the father of the CENTAURS. As a punishment, the feet and hands of Ixion were chained by HERMES to a flaming wheel which perpetually revolved in the lower world, and was compelled to exclaim, "Benefactors should be honored."

IXTACCIHUATL, a mountain peak of Mexico, on the boundary line between the states of Mexico and Puebla. Its summit is barely ten mi. from that of Popocatepetl, with which it is connected by a pass or saddle over which Cortés led his Conquistadors into the valley of Mexico. This snow-clad peak reaches a height of about 17,000 ft. and is the only summit in Mexico having a sufficient ice pack to form glaciers. It was named Ixtaccihuatal, an Aztec word meaning sleeping woman, because the white crest is shaped like a gigantic figure of a woman lying on her back covered with a blanket of snow. The slopes of the mountain are gashed with deep ravines separated by high porphyritic ridges and are covered with timber and vegetation to a height of 13,700 ft.

IYEYASU (1542-1616), Japanese statesman and founder of the Tokugawa shogunate. Iyeyasu, who belonged to the aristocratic Tokugawa family which was a branch of the princely Minamoto clan, had risen to power and prominence during the years when NOBUNGAHODA and HIDEYOSHI were establishing effectively centralized government in Japan. At the time of Hideyoshi's death (1598) he was the most important *daimyo* (feudal lord) in Japan, ruling the Kwanto area, the region around what now is Tokyo. Hideyoshi named him chief of the board of regents who were to act for his infant son. An armed revolt developed, which Iyeyasu crushed in 1600. From that time until his death he was master of Japan, though he did not formally become shogun until 1603 and nominally retired in favor of his son in 1605. Iyeyasu proved himself a brilliant administrative organizer, and the reorganization of the Japanese feudal system which he carried through kept his family in power until the Restoration in 1868. He started his shogunate with little if any prejudice against the Christian missionaries, and he sought to develop foreign trade. Before long he became convinced that the foreign priests were seeking temporal power, and in 1614 he issued a new edict proscribing Christianity. After his death in 1616 his body was interred with great pomp at Nikko.

IZHEVSK, administrative center of the Votyak Autonomous Area of the R.S.F.S.R., in east central European Russia. It is an industrial center lying on the Izh River, which joins the Kama 28 mi. to the south, and down which much lumber is floated. Steel foundries and ammunition factories were established early in the 19th century, but the importance of the town dates from 1917, when it received a town charter. Among the local industries are saw-milling, flour-milling, brewing, brick-making, and the manufacture of agricultural machinery. In the town are St. Michael's Cathedral, a local museum, a workers' institute and a training college for teachers. Pop. 1926, 63,211.

IZMIR or **SMYRNA,** capital of the Aydin vilayet of Asiatic Turkey and the country's largest Anatolian port. The city is located about 200 mi. southwest of Constantinople on the Gulf of Smyrna. It is connected by rail with Constantinople and by branch lines owned by French companies with Afyon-Karahisar and several other important Anatolian cities. Silks, carpets, hides, figs, cereals, raisins, sponges, tobacco and valonia are the principal articles of export.

Izmir is a very old city, and as an early Aeolian colony, it became part of the Ionian League in the 7th century B.C. Because of its commanding position it enjoyed great prosperity and was envied by many rulers. Destroyed by Alyattes, rebuilt by Antigonus and Lysimachus, the city flourished into great magnificence, adorned with beautiful buildings and temples. In one of the latter Homer was worshipped. In the 2nd century A.D. an earthquake destroyed Izmir; its reconstruction was aided by Marcus Aurelius. During the Middle Ages the city belonged to Byzantium, but in the 14th century it was occupied by the Knights of St. John. Devastated again by the Mongolian Tamerlane at the opening of the 15th century, it soon afterward passed into Turkish hands and has remained in their possession up to the present, except for brief occupation by the Greeks after the World War. In the Treaties of Sèvres, 1920, Izmir and the surrounding territory was assigned to Greek administration, on ethnographic grounds. But the Turkish Nationalist warriors under Mustafa Kemel Pasha drove the Greek army out of Anatolia, and in Sept. 1922 reoccupied the city. The Christian population of the city, swelled by refugees from Anatolia, fled before them, upon the outbreak of a disastrous fire which consumed all but the Turkish quarter. Foreign ships in the harbor took off the refugees fleeing from the Turks and the fire. The loss of life was tremendous. Again in Apr. 1928, the town suffered further damage from earthquakes. By the Treaty of Lausanne, 1923, it was confirmed to Turkey. Pop. 1927, 184,254.

J

JABALPUR. *See* JUBBULPORE.

JABIRU, a species of stork (*Jabiru mycteria*) ranging from Nicaragua to Argentine. It is remarkable for its unusual size, standing nearly 5 ft. high, and for its enormous, slightly upturned bill. Its plumage is pure white throughout; the head is bare and black as is also the upper part of the neck, which is proved below with a red distensible band. In the Old World two species occur, the saddle-billed jabiru (*Ephippiorhynchus senegalensis*), found in tropical Africa, and the black-necked jabiru (*Xenorhynchus asiaticus*), which ranges from India to Australia.

JABLONEC NAD NISOU. *See* GABLONZ.

JABORANDI, the South American name for a genus (*Pilocarpus*) of small shrubs of the rue family. The leaves of several species, especially *P. pinnatifolius,* native to Brazil and Paraguay, contain the powerful alkaloid pilocarpine extensively used in medicine as a diaphoretic.

JACAMAR, a family (*Galbulidæ*) of small New World picarian birds closely allied to the puffbirds, found in tropical forests from Mexico to southern Brazil. There are about 20 species, none exceeding 11 in. in length; they have long sharp bills, rather short rounded wings, and weak toes, two pointed forward and two backward. Their plumage is usually coppery, golden green or blackish above, white on the throat and rusty brown below. In habits the jacamars somewhat resemble the insectivorous kingfishers, sitting nearly motionless upon high leafless branches whence they dart in pursuit of passing insects. Little is definitely known about their nesting habits, except that they probably nest in burrows like kingfishers.

JACANA, the common name for a family (*Jacanidæ*) of wading birds allied to the plovers, found about marshes in many warm parts of the world. They are small birds, rarely over a foot in length, of somewhat rail-like appearance, with extremely long toes and claws which enable them to walk with ease over lily pads and other aquatic plants in marshes and ponds. Their food consists chiefly of seeds, tender vegetable matter, insects and small crustaceans. Their nests, in which they usually lay four glossy, spotted, brownish or olive eggs, are simple structures placed on floating masses of reeds or on the ground near water. There are about 12 species of which only one, the Mexican jacana (*Jacana spinosa*) occurs in the United States, ranging from southern Texas to Central America and the Greater Antilles. It is about 9 in. long with a yellow bill, a reddish wattle on the forehead, a sharp wing-spur, and handsome greenish-black and brownish-purple plumage.

JACINTH. *See* ZIRCON.

JACKAL (*Thos*), the name given to an Old-World group of small carnivores, distinguishable from wolves and foxes by size, color and habits. Several species are scattered over the more open parts of all Africa, and thence to India and Burma. They resemble foxes in size and color, make burrows and dens, hunt small prey at night, prowl in the suburbs of towns, bark sharply and live by their wits. Their habit of dogging the steps of larger beasts and feeding on the remains of their kills have made them a synonym of sycophancy which is not wholly deserved.

JACKDAW (*Corvus monedula*), a bird of the CROW family (*Corvidæ*) common in various parts of Europe including the British Isles. It differs from the crow in its much smaller size, measuring only 14 in. in length, in its more slender bill, and in having a broad grayish-white collar on the neck. Jackdaws are somewhat gregarious, dwelling in high rocks, the ruins of castles, and often in cities, building substantial nests in holes in trees, cavities in rocks, chimneys and abandoned places. The eggs, 4 to 6 in number, are usually pale bluish-green in color with bold darker markings. Though feeding chiefly on insects, jackdaws are notorious robbers of the eggs of other birds. Their flight is rapid but irregular, during which they often perform various gyrations, uttering a short clear call, sounding like "jake-jake." The jackdaw is often kept in captivity and trained to talk. *See also* MAGPIE; RAVEN.

JACK-IN-THE-PULPIT (*Arisæma triphyllum*), an attractive early wild flower of the arum family, called also Indian turnip. It occurs abundantly in moist woods from Nova Scotia to Minnesota and southward to Florida and Texas. Rising from an acrid, peppery turnip shaped corm, the plant grows from 1 to 3 ft. high, with a stout fleshy stem bearing one or two large deep-green leaves, divided into three pointed leaflets, and a flower-stalk ending in a conspicuous spathe broadened above into an overarching canopy. Encircled by the oddly shaped spathe, fancifully likened to a pulpit, is an erect club-shaped spadix which bears at its base numerous minute flowers. The fruit, a globular cluster of scarlet berries, is very showy in autumn. By the Senecas and other Indians, the starchy corm, which loses its acridity upon boiling, was used for food.



JACK-IN-THE-PULPIT

JACK KETCH, a hangman in England, between 1663 and 1686, so famous as an executioner that his

successors for almost two centuries were called by his name. He is first mentioned in *The Plotters Ballad,* 1672. His name was given to the executioner in Punch and Judy shows.

JACK RABBIT, a name given, in reference to the long, erectile ears, to the large hares abundant in the more arid parts of western North America. The common species is the blacktailed (*Lepus californicus*), very abundant, especially on sagebrush plains. Jack rabbits are of large size, have gray coats, enormous ears, and long, powerful hind legs, enabling them to attain a high-leaping speed which few dogs can equal. At night, and for rest, they cower inconspicuously beneath a bush, braving the winter without other shelter. These hares, when largely relieved from their natural enemies, such as coyotes and foxes, killed off by hunters and farmers, propagate very rapidly, do great damage to ranchmen's fields and haystacks, and from time to time become such a pest that destructive local drives are necessary, in which thousands are killed in a day. A still larger species, marked by its white sides, prevails along the Mexican border and southward.

JACK SCREW, a mechanical device for raising heavy weights. It comprises a base containing a fixed nut and a SCREW, the latter being raised when turned in the nut. The screw thread, being an INCLINED PLANE, provides "mechanical advantage" which is multiplied by rotating the screw by means of a LEVER.

JACKSON, ANDREW (1767-1845), 7th President of the United States, born on Mar. 15, 1767, in "the Waxhaws," North or South Carolina, of Scotch-Irish parents, linen drapers two years from Ireland, named for his father, who had died a few days earlier. He was intended, by his mother, for the ministry, but he following the wilder side of pioneer life, taking little advantage of his meager educational opportunities. Fighting the British at Hanging Rock in 1780, later captured, wounded for refusing to shine his captor's boots and having smallpox in prison, he was exchanged through his mother's efforts, seeing her die of fever contracted while nursing Waxhaw prisoners on British ships and his younger brother, Robert, die of wounds received as he had his. He came through the Revolution alone at the age of fourteen, as his older brother had been killed earlier at Stono. After trying saddlery and school teaching and visiting Charleston, he studied law at Salisbury, N.C., beginning in 1784, and was said later to have been "the most roaring, rollicking, game-cocking, card-playing, mischievous fellow that ever lived in Salisbury." Jackson began to practice law in North Carolina, but went, in 1788, to Tennessee, where he immediately received much practice and became Solicitor of the District for North Carolina and Federal District Attorney in 1790. In 1791, he married Mrs. Rachel Donelson Robards, daughter of one of the founders of the Cumberland Settlement, and they were remarried in 1794 when it was found they had been mistaken in thinking her divorced from her first husband. Jackson's devotion to his wife and furious resentment to any remark even slightly disrespectful to her, together with his reverence for his mother's memory, made him chivalrous toward women and sometimes quixotic in defending them indiscriminately.

In 1796, already at 29 a man of consequence and property in his community, he was a member of the convention that drew up the constitution for Tennessee, became the first Representative in Congress and in 1797 United States Senator. He did not like the formal Senate and gladly resigned in 1798 to become one of the justices of the Tennessee Supreme Court, and resigned thence in 1804 to be a farmer-merchant and stock raiser. In the House, he had voted with 11 other extreme Republicans against approving Washington's Administrations. Failures of persons whose notes he had accepted embarrassed him financially during these terms of public office, but he applied himself energetically to the scrupulous meeting of every obligation and began to build up a smaller plantation, later called "the Hermitage," to be equal to his first, "Hunter's Hill," sacrificed during the stringency. Failing in his application to Jefferson for the governorship of the Territory of Orleans, Jackson became a confirmed opponent of Jefferson and a follower of Monroe. In 1802, before his resignation from the Supreme Court of Tennessee, he had been elected Major-General and Commander-in-chief of the State Militia, defeating John Sevier, and, thenceforth, divided with him the leadership of Tennessee. In 1805-6, Aaron Burr, on his western tours, visited Jackson, contracted with him for boats to be used in a western expedition, and won his friendship and confidence; Jackson believed Burr merely intent on attacking Spain, not on treason and, being summoned to Richmond in 1807 to testify against him, made, instead, a street speech against Jefferson. Frequently indiscreet, oversensitive and violent in his personal relations, Jackson was among the readiest of a rough age and a rough country to fight formal duels or to fight without prearrangement. In 1806, he killed Charles Dickinson in a duel over racing bets, and received a wound from which he suffered as long as he lived. This, the dispute with Governor John Sevier, and Jackson's only partially successful efforts to retrieve financial losses, kept him out of all public office except his militia command and lessened his political influence until Sevier had retired and Jackson's services in the War of 1812 had reinstated him in public opinion. He kept the militia of his western Tennessee district well organized and ready for quick action, and promptly offered himself and 2,500 volunteers to President Madison when the "War Hawks" brought on the War of 1812. After hastily assembling and leading to Natchez 2,000 volunteers, under War Department orders, Jackson was directed to dismiss them there, but, instead, led them back home on his own responsibility, receiving on this journey the nickname of "Old Hickory," and earning the lasting reputation of standing up for his men, even against high authority, for he saw that they were paid by the National Government. Attacks by the Creeks in

Alabama, Tennessee and Mississippi soon led to the calling back of the Tennessee volunteers, and Jackson showed clearly in this ensuing Indian war the great perseverance, energy and skill of which he was capable in military operations. Having rapidly crushed Indian resistance, he returned to a royal welcome in Nashville. In May, 1814, he was made Major-General in the Regular Army; he then made the Treaty of Fort Jackson with large cessions of territory by Creeks, and, in November, captured Pensacola, because the British were using this Spanish post as a base. Expecting the next British invasion by way of Mobile, he spent several months fortifying it, but was soon called to New Orleans by the news of British plans against it. On Jan. 8, 1815, he repulsed before the City a large British army including many of Wellington's veterans, under the command of General Pakenham, brother-in-law of Wellington. News soon arrived of the treaty of peace previously signed, but the Battle of New Orleans ended the War in a blaze of glory for the United States and gave the Nation a popular hero in the 48-year-old Jackson. Not being sure of the news of peace, Jackson proclaimed martial law in New Orleans, was very high-handed in his measures and came into serious conflict with the civil authorities, even arresting a federal judge who opposed him. The fine of a $1,000 later imposed upon the General for this mistake was returned by Congress with interest in 1843.

When the Army was reorganized on a peace footing in 1815, Jackson was left in command of the southern half, or division, and was able to be at home much of the time. He declined Monroe's offer to make him Secretary of War, but was always keeping his eyes on Florida and welcomed an order, in December, 1817, to direct the war against the Seminoles. Believing he had the indirect authorization of the President, he relentlessly pursued the hostile Indians with overwhelming force from place to place in Florida, destroyed their settlements and supplies, hanged several of their chiefs for attacks upon Americans and executed two Englishmen convicted by court martial of inciting the Indians in their attacks. John Quincy Adams, Secretary of State, led the Monroe Administration in defending these acts vigorously to both England and Spain; censuring resolutions failed in Congress, and the invasion convinced Spain that she had better cede Florida for compensation before the westerners or others should take it gratuitously. Jackson then sanctioned the yielding of claims to Texas as part of the compensation for Florida, but his statement that "for the present, we ought to be content with the Floridas," was typical of the western habit to take what they wanted when they wanted it and to take more when their desires should so extend. Accepting reluctantly the governorship of Florida in March, 1821, Jackson received its surrender, imprisoned the Spanish governor for not turning over records according to the treaty, and resigned the office in December. Retiring to the Hermitage to die, he renewed his bodily strength, previously much weakened by trying southern campaigns with their incidental indigestion and dysentery, built a new, commodious brick residence, rode in a handsome carriage with four gray horses and servants in livery and dispensed a generous hospitality to his many visitors. The Hermitage became a political focus, as had Monticello in the 1790's, and its master became the presidential candidate of a growing circle. As early as 1815, Burr and others had suggested that, with proper management, this western military hero could be made President in 1816, but Jackson had unreservedly supported his friend, Monroe, and reserved his own ambitions for military service in conquering Florida. In 1821, in answer to the suggestion of himself for the Presidency, he said, probably quite sincerely, "No, sir: I know what I am fit for. I can command a body of men in a rough way; but I am not fit to be President." As late as Dec. 6, 1821, he wrote to Gadsden that he was for Calhoun first and Adams second. Six months later, he answered that he would neither seek nor shun the Presidency, and the Tennessee Legislature nominated him July 20, 1822. He again became Senator from Tennessee in 1823. A Pennsylvania convention indorsed this nomination in February, 1824, and named Calhoun for the Vice-presidency. The military hero received 99 electoral votes to Adams's 84. But Clay used his great influence to secure the election of Adams by the House.

Jackson's friends convinced him and the public that their hero had been robbed of the Presidency by a "corrupt bargain" between Adams and Clay, and Jackson was elected in 1828 chiefly on that issue and the resultant demand to "turn the rascals out." "Old Hickory" received 178 electoral votes to 83 for Adams, in one of the bitterest campaigns in the history of the United States. Every actual or alleged mistake of Jackson's whole life was hauled out, exaggerated and broadcasted. His mother's name was disgracefully dishonored. His wife was vilified, and died of a broken heart about six weeks after the election. He now went to the White House as preeminently "the people's President," hardly expecting or expected to live out his term and by many thought to be ready to retire after four years in favor of his Vice-president, Calhoun. But the tough old soldier survived tuberculosis, old wounds and other chronic ailments for 17 years more, effected a political revolution and became the dictator of his party.

Naturally, the change from the Federalistic administration of John Q. Adams to the frontier Jacksonian democracy occasioned an unusual number of changes in minor appointive offices, and Van Buren, Secretary of State, who supplanted Calhoun with Jackson, and the "Kitchen Cabinet" systematized this "patronage" or "spoils system" method of appointment. A wave of democracy from the western frontier, reinforced by the plain people of the older East, had broken up the eastern oligarchy and elected out of the backwoods the first typically American President, to the masses a military hero and idol, to the few who regarded themselves and their kind as divinely ap-

pointed to rule, a terrible old man with a broken body and a vitrified soul. Breaking with Calhoun and sweeping Calhoun men out of his Cabinet, defying the South Carolina Nullificationists at the Jefferson Day Dinner, Apr. 13, 1830, with the toast, "Our Federal Union: it must be preserved," challenging the Second Bank of the United States, Jackson was re-elected in 1832 by 219 votes to 49 for Clay. Tired, sick, lonely and sad, the "Old Hero" aroused himself from his sorrow to marshall the military and naval forces of the nation against the danger threatening from the nullification measures of South Carolina and temporarily found support for his acts even among many of his political enemies. Changing his Treasury head until he had the deposits of public money removed from the Bank of the United States, forcing France to pay spoliation claims long overdue, naming Van Buren, his second Vice-president, to succeed him, Andrew Jackson retired in March, 1837, bowed, feeble and ready to die, but more idolized than any man since Washington and as fiery and determined as ever. He slowly and painfully journeyed through welcoming crowds everywhere, to the Hermitage, rebuilt after a fire in 1836, to use all his savings in paying his debts and to spend eight years of constant pain, waiting for death. He had saved the Union from nullification and from the Bank, paid its debt, resolutely collected its claims and organized his party into an army strong and enthusiastic on his platform of economy and low taxes. He died at home, June 8, 1845. The linen draper's son was, and is, enshrined in the national memory with Washington as one of its greatest heroes and idols. E. J. W.

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JACKSON, CHARLES THOMAS (1805-80), American physician and scientist, was born at Plymouth, Mass., June 21, 1805. In 1833 he began practising medicine in Boston, but soon abandoned this to study chemistry and geology. Jackson asserted that he had first discovered the use of ether as an anesthetic and became involved with Morton in a dispute on that point, after the latter had demonstrated its use in 1846. When the question was referred to the Paris Academy of Sciences for decision, the Academy held Jackson and Morton jointly entitled to credit for the development. Previously (1837) Jackson had disputed with Morse the invention of the telegraph, insisting that he had suggested the idea to Morse. He wrote a number of geological papers. He died at Somerville, Mass., June 21, 1880.

JACKSON, HELEN HUNT (1831-85), American poet and novelist, was born Helen Marie Fiske in Amherst, Mass., Oct. 18, 1831. She was educated at the Ipswich Female Seminary and at a private school in New York. In 1852 she married Capt. E. B. Hunt of the U.S. Army. After the sudden deaths of her husband and two sons, she devoted herself to writing. Though she was particularly known for her verse, she also wrote stories, books of travel and novels. After her marriage in 1875 to William S. Jackson, she lived in the West and became interested in the plight of the American Indian. Her book, *A Century of Dishonor,* brought her fame. In 1884 she published *Ramona,* a novel which depicts the old patriarchal life in California. She died in San Francisco, Cal., Aug. 12, 1885.

JACKSON, SHELDON (1834-1909), American missionary and educator, was born in Minaville, N.Y., May 18, 1834. After graduating in 1858 from Princeton Theological Seminary, he took up home mission work in the middle and western United States, and in 1877 went to Alaska as superintendent of Presbyterian missions. In 1885 Jackson was appointed government agent of education in Alaska, and in this capacity effected marked advances in education and living conditions. He introduced reindeer into the country. Jackson died May 1, 1909.

JACKSON, THOMAS JONATHAN, known as "Stonewall Jackson" (1824-63), Confederate soldier and general, was born at Clarksburg, W. Va., Jan. 21, 1824. He was graduated from the U.S. Military Academy in 1846, and served in the Mexican War as a lieutenant. At the beginning of the Civil War he joined the Confederate army, and at the first battle of Bull Run, July 21, 1861, served as a brigadier-general. Although his left flank was exposed to a fierce rain of artillery fire, he stubbornly held the line firm (hence the soubriquet "Stonewall"). After the battle, he was promoted to the rank of major-general. At Fredericksburg, Dec. 13, 1862, he held the rank of lieutenant-general. On May 2, 1863, Jackson surprised the right flank of Hooker's army at Chancellorsville. The Union troops fled, and Jackson set out to examine the territory. Returning to his camp, he and his men were thought by Confederate outposts to be the enemy, and Jackson was wounded by his own men. His left arm was amputated, but complications developed which caused his death near Chancellorsville, Va., May 10, 1863. Jackson was a man of great personal virtues. He always began a battle with a prayer, and always thanked God aloud for a victory. He was gentle, yet merciless toward his enemies, and had much personal magnetism.

JACKSON, a city of south central Michigan, the county seat of Jackson Co., situated on both sides of the Grand River, about 76 mi. west of Detroit. It is served by the Michigan Central and the New York Central railroads, bus lines and the Reynolds Airport. Jackson is in a farming region and has an extensive trade in agricultural products. Coal and pottery clay are found near by. Manufactured products include automobile parts and accessories. In 1929 the factory output was worth $59,514,377. In 1929 the retail trade reached a total of $41,563,931. Michigan State Prison is located here. Jackson was the birthplace of the Republican Party, which came into existence at a convention held in the city July 6, 1854. About 1830 Horace Blackman and Capt.

Laverty founded a settlement on the site of an Indian camping ground, calling it Jacksonburg in honor of Andrew Jackson. The town received its present name in 1838, and in 1854 was chartered as a city. Pop. 1920, 48,374; 1930, 55,187.

JACKSON, the capital of Mississippi and the county seat of Hinds Co., is situated in the south central part of the state on the Pearl River, about 187 mi. north of New Orleans. The Illinois Central, Gulf and Ship Island, Gulf Mobile and Northern, Yazoo and Mississippi Valley and the New Orleans Great Northern railways, bus lines and an airport providing passenger service to St. Louis, New Orleans and other points, serve the city. Jackson is an important cotton market. The manufactures include lumber and cotton seed products, their value in 1929 amounting approximately to $19,000,000; the retail business in 1929 amounted to $29,550,623. There are large gas fields.

In 1822 the settlement was chosen as the state capital and named in honor of Andrew Jackson. In 1840 Jackson received a city charter. Numerous engagements took place in and near the city during the Civil War. Pop. 1920, 22,817; 1930, 48,282.

JACKSON, a city in southern Ohio, the county seat of Jackson Co., situated 70 mi. southeast of Columbus and served by three railroads. The region has important coal, iron and oil fields; the city has foundries, furnaces, railroad and machine shops. Jackson was founded in 1817 and incorporated in 1847. There are several state parks and forests in this section of Ohio. Pop. 1920, 5,842; 1930, 5,922.

JACKSON, a city and county seat of Madison Co., Tenn., on Forked Deer River, 85 mi. northeast of Memphis. It is served by the Gulf, Mobile and Northern, the Illinois Central, the Mobile and Ohio, and the Nashville, Chattanooga and St. Louis railways and motor buses. The city is a trading, agricultural and industrial center, whose manufactures are chiefly engines, boilers and cotton and wood products. In 1929 the factory output reached approximately $6,000,000; the retail trade amounted to $12,265,299. Union University, Lambuth College, Tennessee's agricultural experiment station and Lane Negro College are located here. Jackson, named for ANDREW JACKSON, was founded in 1821, incorporated two years later, chartered in 1854, and re-chartered in 1907. This region witnessed Civil War maneuvers, 1862-65. Pop. 1920, 18,860; 1930, 22,172; 33% colored.

JACKSONIAN DEMOCRACY, the theory of government associated with Andrew Jackson, President of the United States 1829-33. Its essence was the active participation of the common people in the government. It was a restatement of JEFFERSONIAN DEMOCRACY to meet new conditions, the rise of an industrial and commercial class, which eventually Jefferson had viewed with distrust, and the increasing importance in government of such economic matters as the tariff and banking. Jackson's "democracy," however, stressed the development of partisan political organization, and emphasized practical politics rather than principles of action; property qualifications and any other restrictions upon full manhood suffrage were to be abolished, and public offices should be held for a short time only, so that all citizens might have better opportunity to secure position. The social implications of Jacksonian theory were similarly aimed against customs and conventions which restrained the passion for equality.

JACKSON MEN, the supporters of ANDREW JACKSON in his bitter presidential contest, 1824, and in the recriminations of the next four years. During the ERA OF GOOD FEELING political party distinctions largely disappeared. The presidential election of 1824 was contested by five candidates, all Republicans in name but of varying shades of belief. Andrew Jackson was put forward by William B. Lewis (*see* KITCHEN CABINET), whose astute management made Jackson the leading candidate. In the electoral vote Jackson received 99 votes; JOHN QUINCY ADAMS, with 84, was next highest. In the House of Representatives, upon whom the choice of president devolved because Jackson's lead was less than a majority, the supporters of HENRY CLAY, fourth in the electoral vote, decided the election in favor of Adams. The fundamental principle of the Jackson men was personal prejudice: for Jackson, against Adams. This opposition redefined party lines; the Jackson men emerged as Democrats (*see* DEMOCRATIC PARTY), the supporters of Adams and Clay became Whigs. *See* WHIG PARTY.

JACKSONVILLE, a port city in northeastern Florida, county seat of Duval Co., situated on St. John's River and the East Coast Canal, 42 mi. northwest of St. Augustine. Bus and truck lines, steamships and five railroads afford transportation. There are also well-equipped airport facilities. Jacksonville is a commercial and shipping center for the fruit and farm crops of the region, especially for oranges and pecan nuts. Through its fine harbor on St. John's River the city does a large export trade, the chief products handled being lumber and naval stores. Jacksonville has various manufactures. The most important in 1927 was fertilizers, valued at $7,331,235. The entire manufacturing output, 1929, was valued at $55,178,183. In 1929 the retail business reached a total of $64,491,913; the wholesale trade amounted to $65,314,300 in 1929. Jacksonville is the site of an old Spanish settlement, once known to English speaking people as Cows Ford. The town was laid out in 1822; incorporated in 1832. In 1888 yellow fever was alarmingly prevalent, and in 1901 the city suffered a disastrous fire. Pop. 1920, 91,558; 1930, 129,549.

JACKSONVILLE, a city of central Illinois and county seat of Morgan Co., located on Mauvaiseterre Lake, 35 mi. west of Springfield. Its transportation facilities include motor bus lines and several railroads. The city is surrounded by a corn-growing district; it has natural gas wells and manufactures steel bridges, clothing, shoes and Ferris wheels. In 1929 the value of the factory output was about $6,000,000; the retail trade amounted to $9,128,988. Mainly residential, Jacksonville also is the seat of

important educational institutions, including Illinois College, 1829, McMurray College for Women, 1847, Routt College, 1904, and state schools for the deaf and for the blind. A state hospital for the insane is located in Jacksonville, and Old Salem State Park lies about 28 mi. directly northeast. The city celebrated its 100th anniversary in 1925. It was a station on the Underground Railroad. The city charter granted in 1867 is still in effect. Pop. 1920, 15,713; 1930, 17,747.

JACKSONVILLE, a city in Cherokee Co. in eastern Texas, situated 120 mi. southeast of Dallas. It is served by bus and truck lines and three railroads. Jacksonville is in an agricultural district, raising principally cotton and tomatoes. The chief industries of the city are box and basket manufacture. The surrounding country is rich in natural resources including gas, oil and iron ore. The Murray View Caves are in the vicinity. Jacksonville was founded in 1848 and incorporated in 1873. It is the seat of two junior colleges. Pop. 1920, 3,723; 1930, 6,748.

JACOB, a Hebrew patriarch, son of ISAAC and Rebekah, twin brother of ESAU, is also called Israel, and became the father of the 12 patriarchs who were the ancestors of the 12 tribes of the Israelites. Biblical etymology derives his name from two different circumstances. He is presented to us as the man who stole his father's blessing from his brother, the one who dreamed of the ladder to heaven, who labored seven years to win Rachel for a wife, who tricked Laban out of his property, and who also wrestled with God for a divine blessing. Some scholars have labored to show that he was not a historical person, Winckler even asserting he was one of the Moon gods. The modern tendency, however, is more conservative, holding that he was given an existence through the implication of the national name, "the children of Israel." In his youth he is portrayed as a schemer; in his old age he mellowed. Jacob has been called the biblical prototype of "Dr. Jekyll and Mr. Hyde," and whether the narratives illustrate the life and migrations of a clan or of a patriarch, the moral and spiritual value is undisputed.

JACOB BEN ASHER (c. 1269-1343) (called also Jacob Asheri and Baal Haturim), renowned Jewish commentator on the Pentateuch and rabbinical author, was born at Cologne, Germany, about 1269. He fled to Barcelona with his father and teacher, Asher ben Jehiel, in 1303. Later he served as rabbi, without salary, in Toledo, where he died in 1343.

Jacob ben Asher was extremely well-versed in Jewish literature. He early determined to devote his life to the creation of a complete code of laws for religious practice, and to bring the chaos of Talmudical laws and learning into some sort of systematic order. For this reason he wrote his chief work, the *Arba Turim,* or *The Four Rows,* so-called because of the reference to the four rows of gems on the high priest's breast-plate (Exodus 28:17), each row symbolizing an important division of his work. Many glosses and commentaries were subsequently written to the *Arba Turim.* It was the accepted and highly useful manual of Jewish laws for hundreds of years.

See Graetz, *History of the Jews,* 1926.

JACOB BEN MEIR TAM. *See* TAM, JACOB BEN MEIR.

JACOBEAN ERA, the period in English literature roughly contemporary with the reign of JAMES I (1603-25), when the lyric spirit of the preceding ELIZABETHAN ERA was being directed into more prosaic channels. It was a period of counter-Renaissance, preluding the era of Puritanism. Men's eyes turned from the blossoms of life downward to its roots, and their minds delved in the soil of metaphysics. The great poet of the period was John Donne, those of lesser note were Drummond, Wither, George Herbert, Henry Vaughan; and in a lighter, less representative vein, Robert Herrick. John Milton was born in the Jacobean Era. (*See* separate articles on these authors.) In prose the outstanding works were Robert Burton's *Anatomy of Melancholy* and the King James version of the Bible, 1611. *See also* ENGLISH LITERATURE; ENGLISH DRAMA.

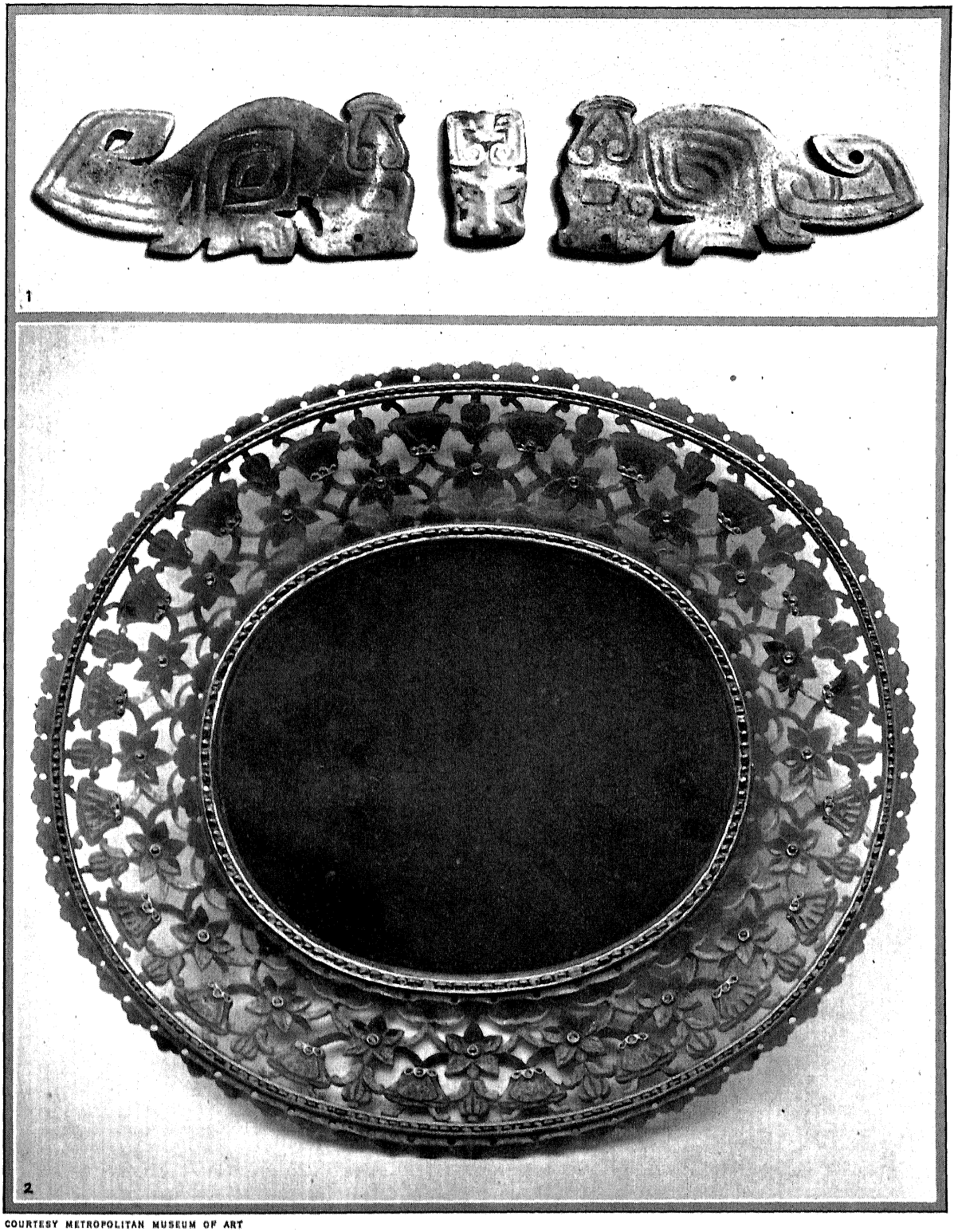
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JACOBEAN STYLE, the term applied to the early Renaissance architecture which followed the ELIZABETHAN STYLE in England. Like the Elizabethan, it was marked by its combination of late Gothic work with classic detail and ornamentation. It differs from Elizabethan work mainly in its greater classicism, but due to the strong Flemish influence, leading to the use of many strictly northern forms, the style is quite distinct from the classic which Inigo Jones introduced after his study in Italy.

The Jacobean period is named from James I (1603-25), but the term is not limited to work during his reign. Jacobean characteristics are seen in construction almost 25 years earlier, and persisted occasionally three-quarters of a century after his death. For bibliography, *see* RENAISSANCE ARCHITECTURE.

JACOBI, ABRAHAM (1830-1919), German-American physician, was born at Hartum, Westphalia (Germany), on May 6, 1830, and educated at Griefswald, Göttingen and Bonn, receiving his M.D. degree in 1851. He was held in detention for participating in the German revolution of 1848. Following his release, he located in New York City in 1853, where he became one of the leading practitioners in diseases of children in this country and founder of American pediatrics, which subject he taught for forty-two years. His many scientific articles, miscellaneous writings and addresses are found in the eight volumes of *Collectanea Jacobi.* In 1854 he made a laryngoscope of his own. He died in Bolton Landing, N.Y., on July 10, 1919.

JACOBINS, THE, were a French political club which under the control of MAXIMILIEN ROBESPIERRE dominated the Government of France during the REIGN OF TERROR. Originally organized as a club of



COURTESY METROPOLITAN MUSEUM OF ART

JADE CARVINGS

1. Chinese jade ornaments of about 500 B.C. in the form of dragons and a bull's head, found in a tomb in H'sin Cheng, in the province of Honan. 2. A carved jade piece set with jewels. East Indian work of the 17th century.

delegates from Brittany at the opening of the States General in 1789, it later became general in memberships, expelled the moderates and by building up a network of connections with similar republican clubs throughout France became the sole political group with a nation-wide organization. It maintained a journal which, along with a somewhat irregular correspondence, served to keep it in close touch with its affiliated clubs in the provinces. Its members were leaders in the Revolution and often well-to-do persons who used the easily inflamed emotions of the Parisian mob. It declined as a political force with the fall of Robespierre in 1794 and was later disbanded. The proceedings and the journal of the Club were edited and published in six volumes by the historian Aulard in 1889-97.

JACOBITES. 1. The English supporters of the Stuart claims to the throne after the overthrow of James II in 1688. They supported the unsuccessful risings of 1715 and 1745, and the sentiment for the "rightful" King lasted, as a sentiment only, in parts of England until the World War, when the heir of the direct Stuart line was Prince Ruprecht of Bavaria. 2. The name is also given to a heretical sect which split from the Eastern Orthodox Church under Bishop James Baradeus in the 6th century. *See* Monophysites; Stuart, House of; Charles Edward Stuart; England, History of.

JACOBS, WILLIAM WYMARK (1863-), English author, was born in London, Sept. 8, 1863. He was educated in private schools and in 1883-99, while serving as a clerk in the Civil Service in London, began writing short stories. His subjects were chiefly the pathetic and humorous incidents in the lives of cockneys and waterfront people whom he depicted with great skill and humor. He has also written several plays. Collections of Jacobs's stories have been published, as *Many Cargoes,* 1896, *Light Freights, Sailors' Knots, The Castaways* and *Sea Whispers,* 1926.

JACOB'S LADDER (*Polemonium cæruleum*), a perennial herb of the phlox family called also Greek valerian and charity. It is a native of Europe and Asia, many floral and foliage varieties of which are widely cultivated for ornament. The erect stem, 1 to 3 ft. high, bears numerous pinnate leaves of many leaflets, and attractive blue flowers in drooping clusters.

JACOTOT, JEAN JOSEPH (1770-1841), French educator, was born at Dijon, France, Mar. 4, 1770. He was the inventor of the universal method of education, which was based on his experiments in the Dijon schools and at the University of Louvain. His theory was that the teacher's function is to stimulate the student to learn, directing him to the proper sources, rather than to actually teach the pupil. He died in Paris July 31, 1841.

JACQUARD, JOSEPH MARIE (1752-1834), French inventor, was born at Lyons, July 7, 1752, the son of a weaver. He learned the weaving trade and after his father's death spent his small inheritance in experimenting with improvements on silk looms. Finally he completed the Jacquard loom which was awarded a medal at the Industrial Exposition of 1801. Although threatened by other silk weavers who were hostile to any labor-saving device, he continued to perfect his machine which was constructed to weave the intricate patterns of decorative fabrics such as brocades, damasks and tapestries. In 1806 his loom was purchased by the state and declared public property, and within six years several thousand Jacquard looms were in operation in France, on each of which Jacquard obtained a royalty. He died at Oullins, Aug. 7, 1834.

JACQUERIE, name of the revolt of the French peasantry following the Battle of Poitiers in 1356. The rising tide of feeling against the nobles, who taxed the country-folk to pay for the Hundred Years' War, broke in May 1358. A minor quarrel led to a widespread uprising in northeastern France, and the maddened peasants, led by one Guillaume Karl, and crying "Death to Gentlemen!" roamed through the valleys of the Oise, Brèche, and the Therain, destroying chateaux, putting inhabitants to the sword, and firing the fields. The revolt was quelled by Charles the Bad, whose forces surrounded the peasants at Meaux and Senlis, and massacred 4,000 of the peasant soldiers. The insurrection derives its name from Jacques Bonhomme, the popular name for the French peasant.

JADE, a general term used for several mineral varieties, nearly white to dark green in color, translucent, and of a compact, massive nature, used as semi-precious stones since prehistoric times. Early man made his ax heads, utensils, amulets and ornaments of jade, these objects having been found in Asia, Europe and America. The Maoris of New Zealand used jade for these purposes within living memory, and to-day ornaments, jewelry and vases of jade are highly prized the world over, especially the carved variety from China.

Strictly speaking, jade applies only to nephrite and jadeite. Nephrite is an Amphibole consisting of a calcium magnesium silicate, tremolite or, with the addition of iron, of actinolite. Tremolite is white to dark gray, whereas actinolite is grayish green to bright green. Nephrite is derived from the Greek for kidney, as the ancients believed it a charm against kidney diseases. Jadeite is a sodium aluminium silicate of the Pyroxene group, white to various shades of green. Nephrite and jadeite are hard, tough and difficult to work.

The jade of China, Mexico and the pre-historic Swiss lake-habitations belongs to both species, whereas that of New Zealand and Alaska is principally nephrite. The most important modern source is in Turkestan. *See also* Gem Stones.

JAEGER, a genus (*Stercorarius*) of predaceous gull-like seabirds, allied to the skuas. There are three widely distributed species all found in North America, though breeding only in the far North. They are large birds, 17 in. or more in length, with blackish

brown plumage, long central tail feathers, hooked bills and webbed toes. The jaegers subsist largely on fish stolen from weaker birds, as gulls and terns, but they also feed upon carrion and various northern fruits, as the crowberry. They nest in colonies on the ground, laying 2 to 4 spotted, olive or brownish eggs. The species include the pomarine jaeger (*S. pomarinus*), 22 in. long, the parasitic jaeger (*S. parasiticus*), 17 in. long, and the long-tailed jaeger (*S. longicaudus*), 21 in. long, all ranging southward as far as the northern United States.

JAFFA, a city of Palestine whose ancient name was Joppa, situated on the coast and serving as a port for Jerusalem about 40 mi. away. Jaffa is mentioned in the Old and the New Testaments and its history is a part of the history of Palestine up to Nov., 1917, when the British seized the city. Jaffa engages in a coasting trade and exports cotton, leather, corn and oranges. Pop. 1931, 51,366.

JAFFNA, a city of Ceylon situated at the northern end of the island on the flat Jaffna Peninsula. Its inhabitants are mostly Tamils. Fishing is the main occupation of its people. In the surrounding country, which is dry and of coral formation, palmyra timber and tobacco are grown and are exported from Jaffna. Rice is cultivated for local consumption. In the 17th century Jaffna was a center of Portuguese missionary activity in northern Ceylon. Est. pop. 1929, 44,160.

JÄGERNDORF. *See* KRNOV.

JAGIELLO, HOUSE OF. The Jagiellonian dynasty, which succeeded that of the Piasts as rulers of Poland, was founded in 1386 by the marriage of Jadwiga, Queen of Poland (grandniece of Kazimir the Great), to Jagiello, Great Prince of Lithuania, who ascended the Polish throne as Vladyslav II. This union resulted in the ultimate fusion of Poland and Lithuania, and established a dynasty which continued until 1572. The founder of the dynasty is its most distinguished figure. Though a pagan, he converted Lithuania. Though no soldier, he defeated the knights of the Teutonic Order at the historic battle of Grünwald, near Marienburg, on July 15, 1410. And though illiterate, he created the University of Wilno. Despite the political dangers which menaced Poland during most of the Jagiellonian period, this epoch was characterized by rapid intellectual advance and material progress.

JAGOW, GOTTLIEB VON (1863-), German foreign minister from 1913-16, was born in Berlin on June 22, 1863, son of the hereditary master of the hunt. After attending the University of Bonn, he occupied a number of local political offices between 1886-95. In the latter year he entered the diplomatic service, eventually becoming ambassador to Rome (1909). In this capacity he was active in the negotiations leading to a renewal of the Triple Alliance in 1912. As foreign secretary at the time of the July crisis in 1914, he was the first German official to learn the exact contents of the Austrian ultimatum to Serbia following the assassination of Archduke Francis Ferdinand. Jagow defended the prewar policies of Germany in a book published in 1919, entitled *Ursachen und Ausbruch des Weltkrieges.*

JAGUAR, an American cat (*Felis hernandesii*), called the tigre in Spanish America, and onca in Brazil; one of the two great native American cats, the other being the puma. It measures 6 to 7 ft. in length and about 28 in. in height; the head and body are heavier and stronger, the limbs and tail shorter but more powerful, than those of the puma or the leopard. In color its skin is buff to tawny, marked with black rosettes and rings, which usually enclose a black spot (the leopard's rosettes have no spot). It is to be found from Texas and Arizona, south to Patagonia. The jaguar is a forest-dweller, and most numerous and well-developed along the Orinoco and in Brazil; but, wary and secretive, it keeps itself in thickets and riverside swamps, and rarely permits itself to be seen. Its food consists of various small creatures that it can catch, but mainly of larger prey, such as tapirs or capybaras, and it is said occasionally to attack alligators resting on shore. In ranching districts it will seize young or weaklings out of a herd of cattle or horses, and is charged with doing much damage. Although quite capable of killing a man and dragging his body away, the jaguar is not aggressive and rarely attacks men unprovoked; yet in some districts the Indians are so afraid of this great cat that they sling their hammocks at night higher than it is able to jump.

Jaguars are rarely hunted in the forest, but in open regions, as the Matto Grosso of Brazil or along the Parana River, they are constantly pursued for sport and to obtain their beautiful skins for the market. This hunting rarely succeeds except by the use of packs of dogs and men on horseback. The jaguar having been discovered, the dogs are put upon its trail and the men follow as fast as they can. If the animal is overtaken and brought to bay, it may take to a tree for safety, and be held there by the dogs; until the men arrive and it is shot. If, however, it takes refuge in some dense thicket into which its pursuers attempt to follow it, it will charge the dogs again and again, usually killing some of them, and will repeat this maneuver with the utmost courage until destroyed. In this reckless boldness it far surpasses in character the puma, which readily gives itself up under similar circumstances. E. I.

JAGUARUNDI, an animal of the cat tribe, an EYRA.

JAHN, FRIEDRICH LUDWIG (1778-1852), German teacher, and "father of gymnastics," was born at Lanz, Germany, Aug. 11, 1778. His interest was early directed to the value of gymnastic training in developing German soldiers for the Napoleonic Wars. In 1811 he opened the first gymnasium in Berlin and not only instilled his students with patriotism but was himself active in the war. After peace was declared he was for a time state teacher of gymnastics; but the Government became suspicious of the

political activities of the gymnasiums and closed these and imprisoned Jahn 1819-24. He died at Freyburg Oct. 15, 1852.

JAINISM, the name of a Hindu religion followed by the Jains, a sect of India numbering over a million members. In many of its principles it is similar to BUDDHISM, Jainism prescribing the same acts of homage and dividing its members into clerical and lay bodies. The Jains are worshippers of Jina, "the victorious," and 23 Jinas who succeeded each other at long intervals. Jainism holds that the world is eternal, that all life is sacred and that Nirvana, or the final emancipation of the soul, represents entrance into blessedness rather than annihilation.

JAIPUR, a capital city and native state in RAJPUTANA, India. The capital is one of the best-planned cities in India. An industrial city, served by the Rajputana-Malwa Railway, its chief industries are jewel-cutting and enamel and metal work. The state of Jaipur is bounded north and west by an extension of the Aravalli Hills; its principal river is the Banas. Barley and millet are the chief products; various precious stones are found, and tobacco and salt are exported. The state, which became a British Protectorate in 1818, is ruled by a maharaja. Area, 15,579 sq. mi. Pop. 1931, city, 144,179; state, 1931, 2,630,977.

JALANDHAR. *See* JULLUNDER.

JALAPA, a city of Mexico and capital of the state of Vera Cruz, situated on the slope of the extinct volcano, Cofre de Perate, at an elevation of 4,800 ft. above sea level, about 60 mi. from the city of Vera Cruz. It is called the Flower Garden of Mexico and is well known as a health resort. The strongly-built houses are of Spanish-Moorish architecture and have iron-barred windows and thick walls. The narrow streets are paved with cobble-stones. Jalapa has hospitals, schools and some unimportant cigar and cigarette factories and cotton mills. There is an old Franciscan convent here, built in 1556; the cathedral was built in 1773 upon a steep slope. Jalap, a well-known medicinal plant, grows abundantly in the surrounding country and gave the city its name. Coffee is also raised and marketed in Jalapa and vicinity. Jalapa is one of the oldest communities in the republic. It was taken by the Spaniards soon after the Conquest but existed long before the time of Cortéz, who is said to have founded the convent of San Francisco. Pop. 1921, 27,632; 1930, 36,234.

JALISCO, a state of Mexico, situated on the Pacific coast, with an area of 31,151 sq. mi. and an elevation of over 6,000 ft. It is divided by the Sierra Madre Mountains into a narrow coast region on the west, sloping to a high tableland, a part of the great central plateau, in the east. The climate varies with the altitudes, from cold in the mountains to temperate on the tableland, and hot on the coast. The mountains are volcanic, some of the most widely known volcanoes in the republic being situated in the state. Among these are Colima, Tapalpa, Tigre and El Nevado. The important rivers are the Rio Grande or *Tolotlan,* the Santiago and the Lerma; the latter flows through the Lake of Chapala, the most noted lake in the republic. Agriculture and mining are the chief industries of the state. Many varieties of fruit, especially oranges, are grown in the lower altitudes; wheat and other grains flourish in the highlands. Gold, copper and silver are the mining products. The capital is Guadalajara, and other cities are Ciudad Guzman, Lagos, Autlan and Ameca. Pop. 1921, 1,191,957; 1930, 1,239,484.

JAMAICA, the principal island of the British West Indies, lying in the Caribbean Sea 90 mi. south of the eastern part of Cuba, about 1,500 mi. due south of New York. Its length is 146 mi. and extreme breadth 49 mi., the total area being 4,450 sq. mi. The coast line has been described as similar to a turtle, the mountain ridges representing the backbone. The principal range, called the Blue Mountains, so named because of the blue haze that usually overhangs them, rises to a level of 7,423 ft., from which eminence the view is described as one of the finest in the world. There are steep declivities covered with stately forests, and the highly fertile valleys are watered by about 100 large and small rivers. These are rapid in their descent from the mountains, cascades are numerous and of exceptional beauty because of the luxuriant vegetation surrounding them. Good harbors occur along the coast. Port Royal, the port of KINGSTON, the capital, est. pop. 1930, 70,252, is the most important seaport. The island has always been subject to earthquakes and hurricanes. The hurricane of 1903 cost Jamaica 65 lives and $12,500,000. Four years later, in 1907, Kingston was totally wrecked by earthquake. In 1912 a terrible cyclone swept over the island.

The climate is its major tourist interest, though it differs greatly on the two sides of the central mountain range. Along the shore the prevailing temperature is warm; inland the air is invigorating. On the low ground the heat is moderated by the sea breezes. Although the annual rainfall on the north slope of the Blue Mountains is 100 in., it is less than half this amount at Kingston. The improved drainage and sanitation arrangements have reduced the danger of malaria, and yellow fever is no longer prevalent.

The forests produce rosewood, satinwood, logwood, ebony, braziletto, cedar, yacca and mahoe. Mahogany trees are about extinct. The island is favorably situated for banana growing and the colony is able to produce and export more than 20,000 bunches a year, valued in 1932 at more than $15,000,000. More than 30,000,000 coconuts are exported annually. Pineapples grow freely in the pastures, and the finest orchids occur in the woods. Tangerine oranges grow wild on the hills. Of flowering plants there are 2,180 distinct species, and of ferns about 450. Other products include ginger, tea, coffee, tobacco and cinchona. Guinea-grass grows wild and reaches 4 to 6 ft. in height; it is highly esteemed for pasturage. Cattle-raising is an important industry. The population was estimated at 994,419 in 1929 in addition

to 16,000 whites, and consists of Negroes, East Indians, Chinese, Syrians and half-breeds.

History. Discovered by CHRISTOPHER COLUMBUS on May 3, 1494, Jamaica came under Spanish rule in 1509 with the appointment of a royal governor. English raids in 1596 and 1635 did not result in English occupation, but in 1655 the British captured the island, and in the next three years drove out the Spaniards. Before 1670, when the Treaty of Madrid formally ceded the island to Great Britain, the island was the favorite resort of pirates, who masked their doings by engaging in trade and planting. When the Royal African Company gained a monopoly of the slave trade in the 1670's, it made Jamaica one of the most active slave markets of the world. The slave trade was abolished in 1807, and emancipation was granted in 1833 to a quarter million blacks. The latter act of Great Britain destroyed the prosperity of the planting class, as did the heavy taxes and arbitrary government of the royal governors. After 1865 the colony was annexed to the crown, and government under Sir John Grant materially assisted in restoring the prosperity of the island. During his rule the banana trade with America began, which gradually restored Jamaica's old prosperity. In 1907 a devastating earthquake caused the destruction of practically all of Kingston and Port Royal, the two principal municipalities, and the death of 800 islanders. It also occasioned a disagreement with the United States through the landing of American Marines for assisting the civil authorities. The disagreement resulted in the replacement of the incumbent governor by Great Britain. In the World War Jamaica contributed 631 officers and 11,000 men to the armies of Great Britain.

JAMAICA, a part of Queensborough, incorporated into the city of New York in 1898. Situated 8 mi. from Brooklyn and served by the Long Island Railroad. Jamaica has many manufactures.

JAMBI, a town of the Dutch East Indies, the largest of the Jambi Residency, in the island of Sumatra. It is situated on both banks of the Jambi River, about 130 mi. from Palembang. In the town and vicinity interesting Hindu sculptures have been discovered. Jambi is the principal export point of the rubber grown in the region. Coffee also is exported in large quantities. Est. pop. 1931, 16,000.

JAMBOL, a Bulgarian town in the district of Burgas on the railway between Philippopolis and Burgas. It has a large trade in agricultural products, particularly in grain. Some of the best cattle in Bulgaria are raised in the district. The Turkish appearance of the town is preserved by the old wooden houses and the ruins of a large mosque. Pop. 1931, 23,254.

JAMES, ST., the Elder, one of the twelve disciples of Jesus. He and his brother John (*see* JOHN, ST.) were sons of Zebedee and probably of Salome. His call to be a disciple, received when he was a fisherman, was followed some months later by his appointment as one of the Apostles. With John he is described as one of the "sons of thunder," and appears in the Gospels with Peter (*see* PETER, SAINT) and John in those incidents in the life of Jesus, where his three favorite followers take an intimate part. Among the narratives in which he thus appears are those dealing with the raising to life of the synagogue teacher's daughter, the Transfiguration and the prayer in



ST. JAMES THE ELDER
By the German engraver, "E. S."

Gethsemane. He was killed by Herod Agrippa I, in 44 A.D., and is the first Apostle whose death is recorded in the New Testament. Legend states that before his death he was a missionary in Spain, and that his companions conveyed his body, some assert, miraculously, from Jerusalem to Compostella in Spain, where it was enshrined. We are told further that in 829, his miracle-working bones were discovered, and that his apparition in luminous armor struck terror into the Saracens.

JAMES, ST., the Younger, the son of Alphaeus, is called by Mark "James the Less," and is believed to be James, the Lord's brother, the author of the GENERAL EPISTLE OF JAMES. His identity has been confused since the earliest days of the Church, some holding that there were three men of this name prominent in the early Church. The question has also become involved with the belief of some in the perpetual virginity of Mary, the mother of Jesus, so that many hold that he was the son of the other Mary, the wife of Clopas, and hence was a cousin of Jesus. He is described as holding office in the church at Jerusalem, and as president of the council that met there in 50 or 51 A.D. The testimony of antiquity leaves no doubt that he met a violent death at the hands of Jewish zealots about 63 A.D., and a dramatic account of his martyrdom is given by Eusebius. If he was the author of the epistle, he was a strong advocate of justification by good deeds as well as by faith.

JAMES I (1566-1625), King of England (James VI of Scotland) was born at Edinburgh Castle on June 19, 1566, the only son of Mary Stuart and Lord Darnley. Upon Mary's forced abdication in 1567, he was recognized as King of Scots and was brought up at Stirling Castle while a succession of Regents ruled the country. So weak was he as a boy that even at the age of seven he could hardly stand. His portrait reveals a pale, dull-looking child with short, light reddish hair. With the historian George Buchanan as his principal tutor, James acquired a knowledge of Latin which he was fond of displaying. His mother's execution in 1587 secured his position as king and eliminated the continual risings in her favor. In 1589 he married Anne of Denmark. On the death of Elizabeth in 1603 he inherited the English crown, but he was never popular in England. He had an ugly physique and spoke with a Scotch burr. The moral condition of his court was low and with the Stuart love of favorites he allowed the moral tone of the court to decline greatly. He was firmly convinced, as was his son Charles, of the divine right of kings, as may be seen in his *Basilikon Doron* and other writings. He will always be remembered as having authorized, in 1611, the translation of the Bible which bears his name. Sir Walter Scott offers a masterly portrait of James I in his *Fortunes of Nigel.* The king died on Mar. 27, 1625.

JAMES II (1633-1701), King of England was born at St. James's Palace, London, Oct. 12, 1633, the second son of Charles I, and was created Duke of York. In exile during the commonwealth, he served with the French under Marshal Turenne. At the Restoration, his elder brother, Charles II, appointed him Lord High Admiral, in which office he greatly developed the British navy during the critical period of the naval wars with the Dutch. In 1672 he declared himself a Roman Catholic, and as a result of the Test Act, passed the next year, he had to resign his public offices. A bill to exclude him from the succession passed the Commons in 1679, but was later defeated in the House of Lords. In 1685 James ascended the throne, but the glorious revolution of 1688 soon terminated his reign and the king fled to France. He attempted to regain his throne by support from Ireland, but was defeated at the BATTLE OF THE BOYNE, and thereafter until his death lived at St. Germain-en-Laye near Paris as the pensioner of Louis XIV.

In 1659 James secretly married Anne Hyde, daughter of the Earl of Clarendon, and, by her, he had eight children of whom two daughters, Mary and Anne, brought up as Protestants, succeeded him on the throne. In 1673 he married Mary of Modena by whom he had seven children, the eldest being Charles Edward, the Pretender, born in London, June 10, 1688. He also had children by two mistresses, Arabella Churchill and Catherine Sedley. James died at St. Germain, Sept. 6, 1701.

JAMES I (1394-1437), King of Scotland, was born at Dunfermline, Scotland, in July 1394, the son of Robert III. En route to France in 1406, he was captured by the English, and imprisoned in the Tower of London. Henry IV of England removed him to Nottingham Castle, where for 18 years he was an English hostage. During this period he wrote the *King's Quhair* and other verses. In 1425 Scotland paid 60,000 marks ransom for his freedom, and James, after marrying Jane, daughter of the Earl of Somerset, entered Scotland and was crowned. During his reign of 13 years he introduced statute law into Scotland, and was the author of much progressive legislation. His vigorous attempts to curtail the power of the nobles and his cruelty to heretics having aroused the nobility, he was assassinated by Sir Robert Graham at Perth on Feb. 20, 1437.

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JAMES IV (1473-1513), King of Scotland, was born Mar. 17, 1473, and ascended the throne in 1488 upon the murder of his father, James III. He was gay, generous, active, physically strong, well-educated and his wide interests included science. In his reign Aberdeen University and the College of St. Leonard's at St. Andrews were founded. In 1503 he married Margaret Tudor, daughter of Henry VII of England, and their descendants later inherited both thrones. (See JAMES I of England.) Invading England in 1513 James was defeated and killed Sept. 9 on FLODDEN FIELD.

JAMES, HENRY (1843-1916), Anglo-American novelist and essayist, was born in New York City, Apr. 15, 1843. He began his prolific literary career in 1865, after travel and study in Europe. Among his novels are *Washington Square, The Bostonians, Daisy Miller, The Portrait of a Lady,* and *The Ambassadors.* He wrote a large number of short stories and many volumes of essays, travel, biography and literary criticism. The greater part of his life was spent in Europe, chiefly in England, France and Italy, and in 1915 he became a naturalized British subject. James's method was that of the realistic objective psychologist, and he sought to portray with the utmost exactness minute details of conduct, interpreting through them motives, mental processes and all the devious ways and implications of the inner life. In such works in his later manner as *The Golden Bowl* and the unfinished *Ivory Tower,* James revealed completely his gifts as a technician, a master of the psychological situation at its furthest, most tenuous reaches. He also revealed, however, his fatally diminishing contact with all life outside the rarefied atmosphere in which alone his elaborate technique could have its being. He died in London, Feb. 28, 1916.

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JAMES, WILLIAM (1842-1910), American philosopher and psychologist, was born in New York City, Jan. 11, 1842. In 1867-68 he studied in Germany and the following year received his M.D. from Harvard. From 1872-76 he taught physiology at Harvard. His interest in biology and physiology led him over into psychology. At all times, however, he was interested in philosophical issues. James's phi-

losophy was influenced largely by his own personal problems. A constant struggle for health probably made him more religiously inclined than he otherwise would have been. Although he was in no sense a traditionalist and his philosophy looked toward the future, he never adopted a thoroughgoing naturalism, as JOHN DEWEY has done. For many years James was intensely interested in psychical research. His last lecture at Harvard was given in 1907. He died at Chocorua, N.H., Aug. 26, 1910.

James's writings may conveniently be grouped into three periods. The first represents his interest in psychology, which culminated with the publication of his classic work, *The Principles of Psychology,* 2 vols., 1891. The second is characterized by a dominant religious interest which reaches its heights with his Gifford Lectures on *The Varieties of Religious Experience,* 1902. Other works belonging to this period are his *Will to Believe and Other Essays,* 1897; *Human Immortality,* 1898, and *Talks to Teachers,* 1899. The third period finds him as the champion of the pragmatic faith. Here fall his celebrated lectures on *Pragmatism,* 1907; *The Pluralistic Universe* and *The Meaning of Truth,* 1909. Also may be included the posthumous publications, *Some Problems of Philosophy,* 1911, and *Essays on Radical Empiricism,* 1912.

James was not a systematizer. For this reason it is somewhat difficult to organize his ideas. As a writer he possessed an inimitable style. His lectures on *Pragmatism* are classic and did much to popularize this philosophy. His chapter on habit has become a standby in educational theory. The James-Lange theory of emotions is still one of the best explanations we have. A master of introspection and observation, his insight into human nature has never been surpassed. His *Varieties of Religious Experience* opened up a psychological approach to religion that has led to significant developments. His conception of the finite God has had a strong influence on theology.

JAMES, GENERAL EPISTLE OF, in the New Testament, was written to Jewish converts from Judaism and is addressed to the "twelve tribes who are scattered over the world." From an early date its authorship has been questioned. Eusebius says that it was by some accounted spurious; Origen expresses doubts; Jerome says that it was written only in the name of James. Luther calls it "an epistle of straw," because of its insistence on justification by "works" as well as faith. Of the four persons named James in the New Testament, the one to whom it has been commonly attributed is James, the Lord's Brother (*see* JAMES THE YOUNGER), also known as James the Less, and James the Just, who was bishop or president of the church in Jerusalem. The emphasis on the teaching that "faith apart from works is barren" is usually interpreted by the Church in the saying, that Paul speaks of "justification of the ungodly, in relation to their acceptance by God, and James of the justification of the godly in relation to their approval by God." It is the epistle which inculcates practical morality, self-control in speech and temper, brotherly love, the curse of ill-gotten gains and the sinfulness of discriminating against the poor in favor of the rich.

JAMES MILLIKIN UNIVERSITY, Decatur, Ill., a coeducational, non-sectarian and privately controlled institution founded in 1901 by the Amalgamation of Lincoln College, Lincoln, and the Decatur College and Industrial School. It was named for its benefactor, James Millikin, and is under the supervision of the Presbyterian Synods of Indiana, Illinois and Iowa. It had productive funds in 1931 amounting to $1,629,618. The library contained 24,975 volumes. In 1931-32 there were 1,132 students, and a faculty of 60, headed by Pres. Mark E. Penney.

JAMESON, JOHN FRANKLIN (1859-), American historian, was born near Boston, on Sept. 19, 1859. He was graduated from Amherst in 1879. In 1888 he was appointed professor of history at Brown University, resigning in 1901 to become professor of history at the University of Chicago. He was associate editor of the *American Historical Review* from 1902, and managing editor from 1895 to 1928, with the exception of the four years, 1902-05. In 1905 he was made editor of the historical publications of the Carnegie Institution, and in 1928 became chief of the division of manuscripts in the Library of Congress at Washington. He served as president of the American Historical Association in 1907.

By his scholarly collecting and editing of original documents, Dr. Jameson made a signal contribution to American history. He was also influential in stimulating government aid to historical research. His writings on historiography are of notable value in clarifying the tasks of American historians. Among his works are: *The History of Historical Writing in America; The American Revolution Considered as a Social Movement;* and *Encyclopedic Dictionary of American History* (with J. W. Buel). He edited *Original Narratives of American History,* and *Privateering and Piracy in Colonial Times.*

JAMESON, SIR LEANDER STARR (1853-1917), British colonial statesman, was born at Edinburgh. He studied medicine in London but, because of ill-health, went to South Africa, in 1878, to practice there. When the British South African Company was formed, he threw in his lot with them. In 1895 he led a body of Outlanders in a raid into the Transvaal to compel the Boers to open up their territory to foreign miners and prospectors. The raid caused his trial and imprisonment in England; on his release he returned to South Africa, and was made prime minister in 1904. He was created a K.C.M.G. in 1909. The latter part of his life was devoted to business in London where he died, Nov. 26, 1917.

JAMESON RAID, an attack upon Johannesburg, South Africa, in 1895 in an attempt to annex the Transvaal Republic to the British Cape Colony. The plan was arranged by Leander Starr Jameson, afterwards knighted, in association with Cecil Rhodes, then prime minister of the Cape Colony. The object was to raid Johannesburg from British terri-

tory across the Vaal at the moment that resident Britishers in Johannesburg attempted to seize control. Delays occurred, and Jameson, becoming impatient, crossed the Vaal before anything was in readiness at Johannesburg. Jameson was easily captured by President Kruger's troops and turned over to the British government. After a few months' imprisonment he was released. The conspirators in Johannesburg were heavily fined and some were imprisoned for a short period. *See* BOER WAR.

JAMES RIVER, the largest stream in Virginia, formed by the Jackson and Cowpasture rivers which rise in the Allegheny front and unite at the northern extremity of Botetourt Co. It flows generally east across the Appalachian valley and passes through the Blue Ridge at Balcony Falls where the scenery is unusually beautiful. Continuing eastward, the James traverses the Piedmont region and at Richmond crosses the fall line with an abrupt descent of 84 ft. which marks the head of navigation. Just below Richmond it meets the tide and throughout the 111 remaining mi. of its course is a tidal estuary, communicating with Chesapeake Bay through Hampton Roads. The total length of the river is about 320 mi. and its fall is 1,014 ft. With its main tributary, the Appomattox, it drains 10,060 sq. mi. Jamestown, founded in 1607 and the first permanent English settlement in America, is situated on this stream.

JAMESTOWN, a city of Chautauqua Co., southwestern New York, situated at the mouth of the Chadakon River, at the southern end of Lake Chautauqua, about 68 mi. southwest of Buffalo. It is served by two railroads and by steamboats which make regular trips during the season to all the summer colonies on Lake Chautauqua. Jamestown is built in the hills at an elevation of over 1,300 ft. and is the center of a scenic summer resort region. The famous Chautauqua Institute, located on the lake nearby, attracts many visitors to the city. Good local water power and natural gas from Pennsylvania combine to make Jamestown an important manufacturing city and the principal center in the East for wooden and metal furniture, metal doors and interior trim. Woolen goods are extensively produced. In 1929 the value of manufactures was about $54,000,000; the retail trade amounted to $30,838,021. Agricultural interests include dairy, fruit and poultry products. The foreign-born residents of the city are mainly Swedish. Settled in 1810, and named for a pioneer, James Prendergast, Jamestown was incorporated in 1827 and in 1886 received a city charter. Pop. 1920, 38,917; 1930, 45,155.

JAMESTOWN, a city in southeastern North Dakota, the county seat of Stutsman Co., situated in the James River Valley, 100 mi. west of Fargo. Bus lines and two railroads afford transportation. Jamestown has railroad shops, creameries and flour mills. The city is surrounded by good farming and stock-raising country. Located here are Jamestown College and the State Hospital for the Insane. Near by, and within Stutsman Co., are one National, three State monuments; Fred Smith, Homer, Ft. Seward and Arrowwood National Park. Jamestown was incorporated in 1883. Pop. 1920, 6,627; 1930, 8,187.

JAMESTOWN, the first permanent English settlement in America, founded in 1607 in what is now James City Co., Va., about 40 mi. northwest of Norfolk. It was the capital of Virginia until 1698, when the seat of administration was moved to the present Williamsburg. From that time forward Jamestown rapidly declined until only a few ruins remained. With the opening of the 20th century, however, work was begun to preserve and restore the surviving structures in the old town. *See also* VIRGINIA, *History.*

JAMESTOWN COLLEGE, at Jamestown, N. D., a coeducational institution, privately controlled by the Presbyterian Church of America, was opened in 1884. It closed nine years later, and was reopened in 1909 by the Presbyterian Synod of North Dakota. The productive funds in 1931 were $1,044,812. The library had 13,000 volumes. In 1931-32 there were 540 students and a faculty of 30, headed by Pres. Barend H. Kroeze.

JAMI (1414-92), Persian poet, scholar and mystic, whose full name was Nured-Din Abdur Rahman, was born at Jam, near Herat, in Khorasan, Nov. 7, 1414. *Jam* being Persian for cup, the poet's name signifies the divine cup of love in mystic symbolism. Jami was gentle and learned and a master of language, intimate with the Sultan and author of more than 44 works. This great student of mysticism lived a life of contemplation as a professed Sufi. His most distinguished work, the *Seven Thrones,* consists of seven romantic love poems, the most famous of which are *The Loves of Joseph and Zalikha* and *Salaman and Absal;* the latter has been translated into English verse by Edward Fitzgerald. His *Baharistan* or *Garden of Spring,* 1487, contains a history of Sufism. Jami died at Herat, Nov. 8, 1492.

JAMNAGAR, a town and native state in the Western India State agency, Bombay, India, better known as NAWANAGAR.

JAMSHEDPUR, an industrial city in Behar and Orissa, British India, at the junction of the Subarnarekha and Kharkhai rivers. Founded in 1909 Jamshedpur has grown to be the third largest city in the province. It is served by the Bengal-Nagpus Railroad. Thousands of tons of steel are produced annually. Pop. 1921, 57,041.

JANE EYRE, a remarkable novel by Charlotte Brontë (*see* BRONTË FAMILY); published 1847. Jane Eyre—admittedly an autobiographical figure—is an orphan who, after an unhappy childhood and a wretched career at Lowood School, becomes a governess at "Thornfield," the country-house of the wealthy, eccentric, admirable Mr. Rochester. Jane's independence of mind appeals so strongly to Mr. Rochester that he proposes marriage. Ignorant that Mr. Rochester's wife, a drunken insane creature, lives under a keeper's charge on the third floor at Thornfield, Jane consents, leaving Thornfield abruptly, however, when she knows the real truth. She returns

later, finds Rochester blinded by his crazed wife, now mercifully dead, and at last marries him.

JANESVILLE, a city in southern Wisconsin, the county seat of Rock Co., situated on the Rock River, 30 mi. southeast of Madison. Bus lines and two railroads serve the city. The countryside produces tobacco and grain. The chief industries are handling products for shipping and the manufacture of automobiles, clothing and fountain pens. In 1929 the factory output reached approximately $112,000,000; the retail business was valued at $14,628,680. It is the seat of the Wisconsin School for the Blind. Pop. 1920, 18,293; 1930, 21,628.

JANINA. *See* YANNINA.

JANISSARIES. In the 14th century the Ottoman leader, Orkhan (1326-59) organized a permanent force of infantry known as the New Troops or *Yani-Chari,* later Anglicized into Janissaries. The organization of this army was greatly improved under Orkhan's successor, Murad I, 1359-89, and by the opening decades of the 16th century the Janissaries were powerful enough to cause the deposition of Bayezid II, 1481-1512. During the reign of Suleiman the Magnificent, 1520-66, the Janissaries numbered perhaps 12,000 to 14,000 men. They were recruited chiefly from among the healthiest boys of the Christian subjects of the Turks—this being, of course, a form of tribute. Controlled by an iron discipline, prohibited from marrying, and maintained in an excellent living, the Janissaries soon achieved a fame for prowess and strength in battle unparalleled by any other fighting force. Since their business consisted of fighting, these soldiers generally were much attached to war-like sultans, but frequently proved unruly and rebellious under weak rulers.

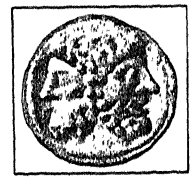
The general decline of Turkish power which took place under Selim the Drunkard, 1566-74, and some of his successors, was reflected in the degeneration of the Janissaries. By the middle of the 17th century their number had increased to almost 50,000, their discipline had come to be a matter of history, and their membership had come to be recruited from grasping Moslem subjects who were anxious to secure the advantages accruing from association with the sultan's bodyguard. In proportion as their number of victories over foreign troops decreased, the Janissaries became more arrogant in their attitude toward the Turkish sultans and subjects. By 1800 many of the men lived at home with their families, rarely reporting for duty except on paydays.

Accordingly, when the energetic Mahmud II, 1808-39, came to the throne, he regarded the destruction of the Janissaries as one of the most urgently needed reforms of his empire. Not until June, 1826, however, did he feel strong enough to publish an order abolishing the ancient privileges of the Janissaries. When the soldiers thereupon revolted, Mahmud's newly organized artillery corps made short shrift of the rebels. In their last stand the Janissaries once more proved their courage, but their decadent organization foredoomed them to defeat. W. C. L.

JANSEN, CORNELIUS (1585-1638), Dutch theologian, upon an interpretation of whose teachings the Jansenists were founded, was born at Accoi, near Leerdam, in the Netherlands, Oct. 28, 1585. He was educated at Louvain, and studied Greek in Paris. In 1616 the College of St. Pulcheria at Louvain was under his control. His teachings and his antipathy toward the Jesuits made him extremely unpopular and he narrowly escaped the Inquisition. In 1636 he was made bishop of Ypres. His chief work is the *Augustinus, seu doctrina S. Augustini de humanae naturae sanitate, etc.,* which was published posthumously in 1640, and did much to disseminate his views in the 17th and 18th centuries. His doctrine is described in the *Catholic Dictionary* as "A heresy which consisted in denying the freedom of the will and the possibility of resisting divine grace" under "a professed attempt to restore the ancient doctrine of the church." Protestants regard it as "a reaction within the Catholic Church against the theological casuistry of the Jesuits." Jansen died at Ypres, May 6, 1638.

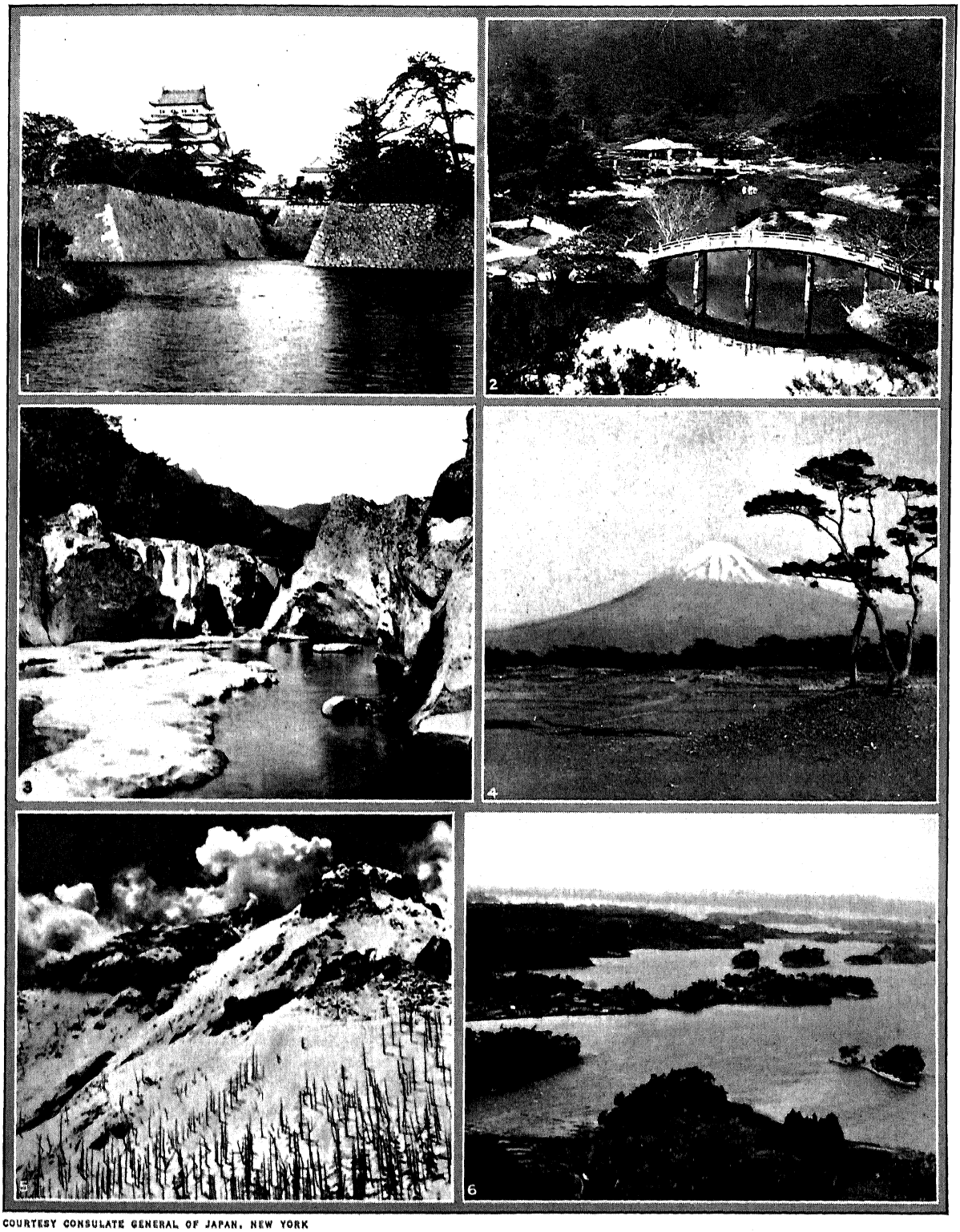
JANSENISM, the name given to the theological doctrines of the Catholic bishop of Ypres, Cornelius Jansen (1585-1638), which obtained many followers in France and elsewhere in the 17th and 18th centuries. Jansenists held that man, being a fallen creature, was incapable of doing anything in accordance with the will of God and was equally unable to withstand the work of divine grace, through which alone he could be saved. Jansenism had much in common with some of the best-known doctrines of CALVINISM, was advocated as a restoration of Augustine's belief and was directed chiefly against the Jesuits. The most famous center of the Jansenist movement was known as the Port Royal school, founded by the Abbé de Saint Cyran, of which Blaise Pascal was a member. The last great supporters of the belief were Antoine Arnauld and Pasquier Quesnel. The Catholic Church treated the doctrine as heretical.

JANUARIUS, ST., bishop of Benevento and patron saint of Naples, was born, according to legend, in the south of Italy in the 3rd century, during the persecutions of Diocletian and Maximian. He was martyred because he refused to renounce the Christian faith. The Miracle of St. Januarius is the liquefaction of his blood kept in a glass phial, which takes place several times during the year when the phial is placed near his head. St. Januarius was also the name carried by many African martyrs during the Vandal conquest of the 5th and 6th centuries and the Mohammedan-Arab conquest of the 7th century. There are also several Armenian martyrs of this name.



JANUS
From an ancient coin

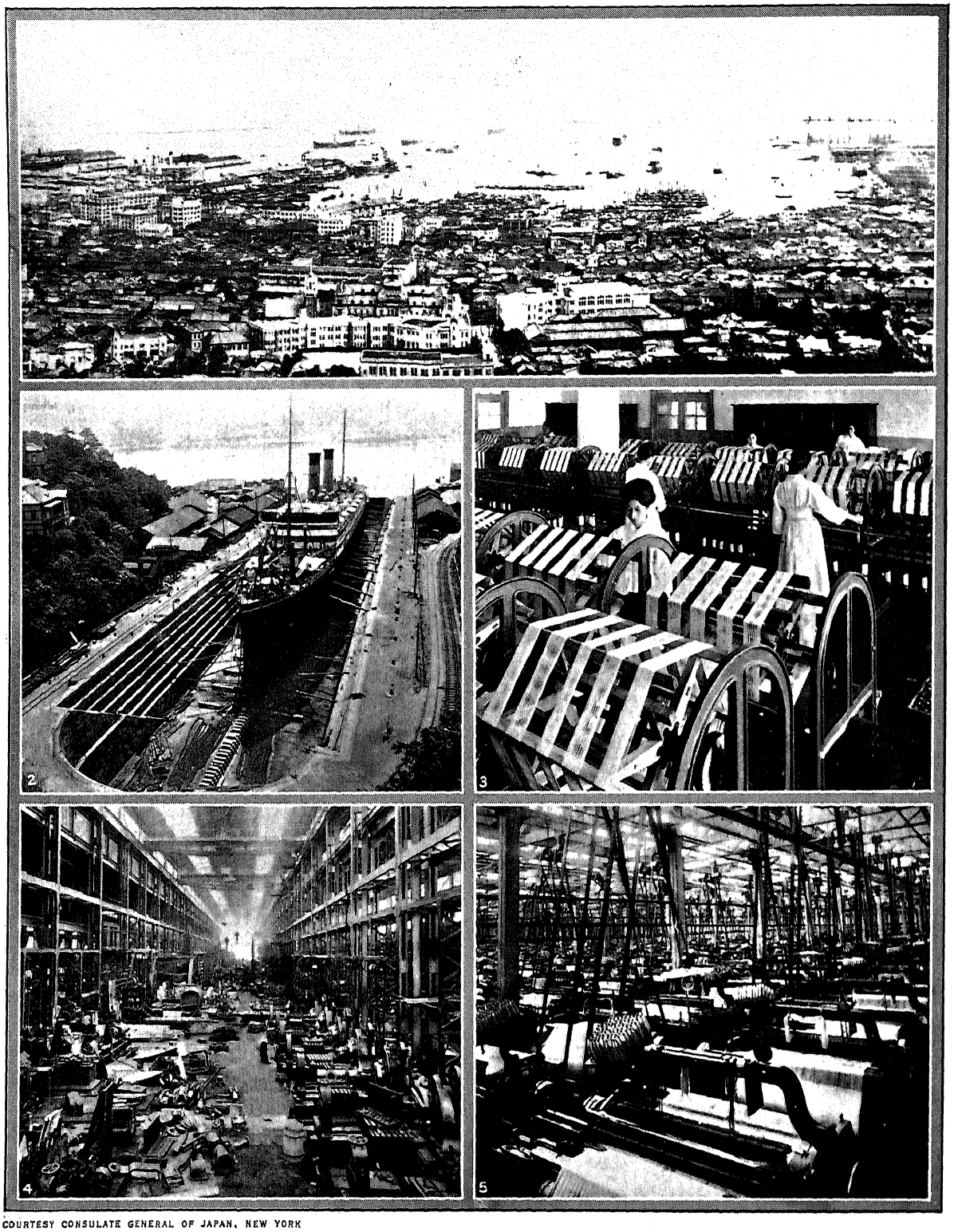
JANUS, in Roman mythology, the god of all openings or beginnings, in material things such as gates, and in abstract things such as the undertaking



COURTESY CONSULATE GENERAL OF JAPAN, NEW YORK

VIEWS OF THE JAPANESE COUNTRYSIDE

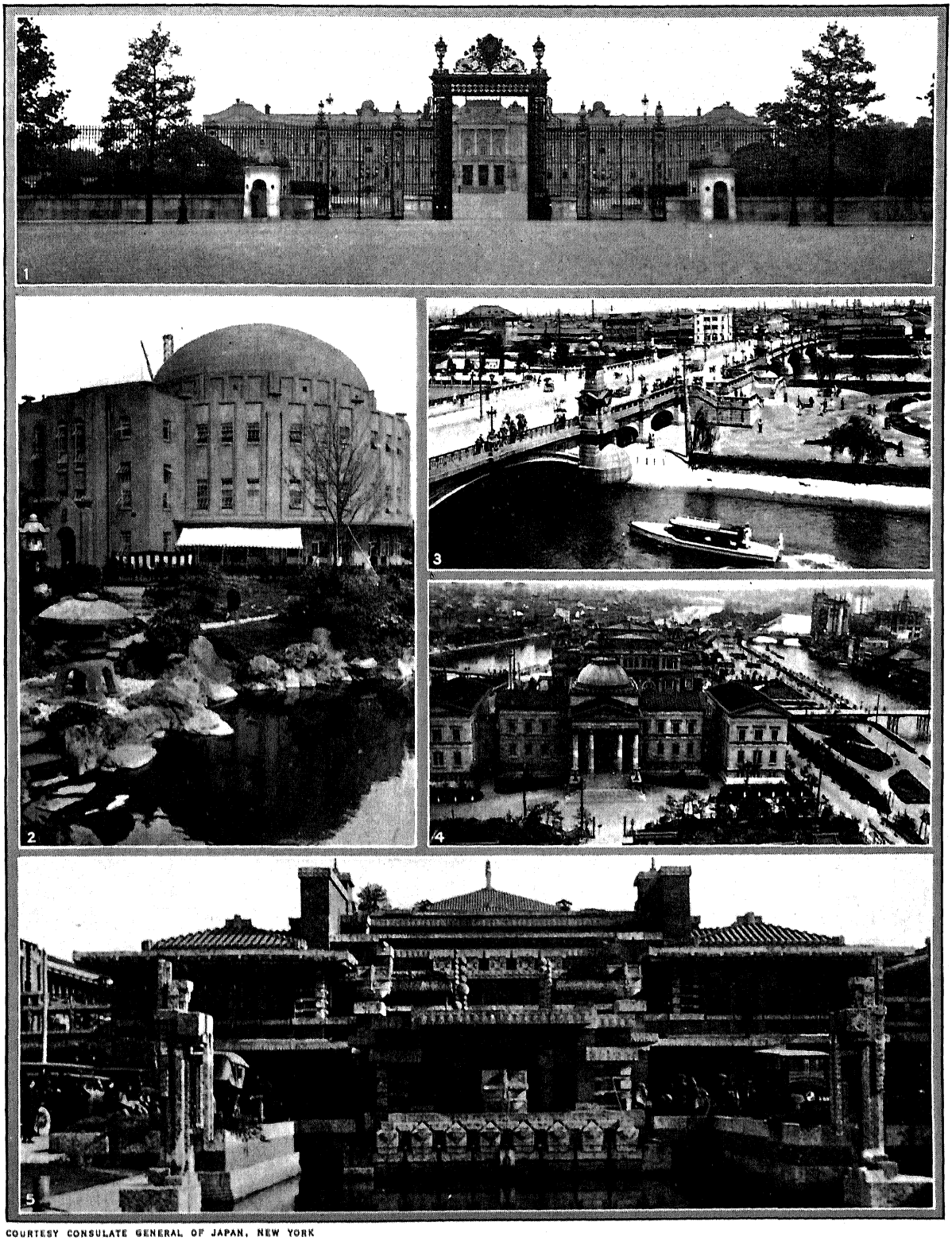
1. Nagoya Castle near Nagoya City. 2. Kuriboyaski Park.
3. "Yabokei" landscapes. 4. Fujiyama from Miho Pine-Tree Grove. 5. Peak of a volcano. 6. Pine-Tree Islands.



COURTESY CONSULATE GENERAL OF JAPAN, NEW YORK

MODERN INDUSTRIAL JAPAN

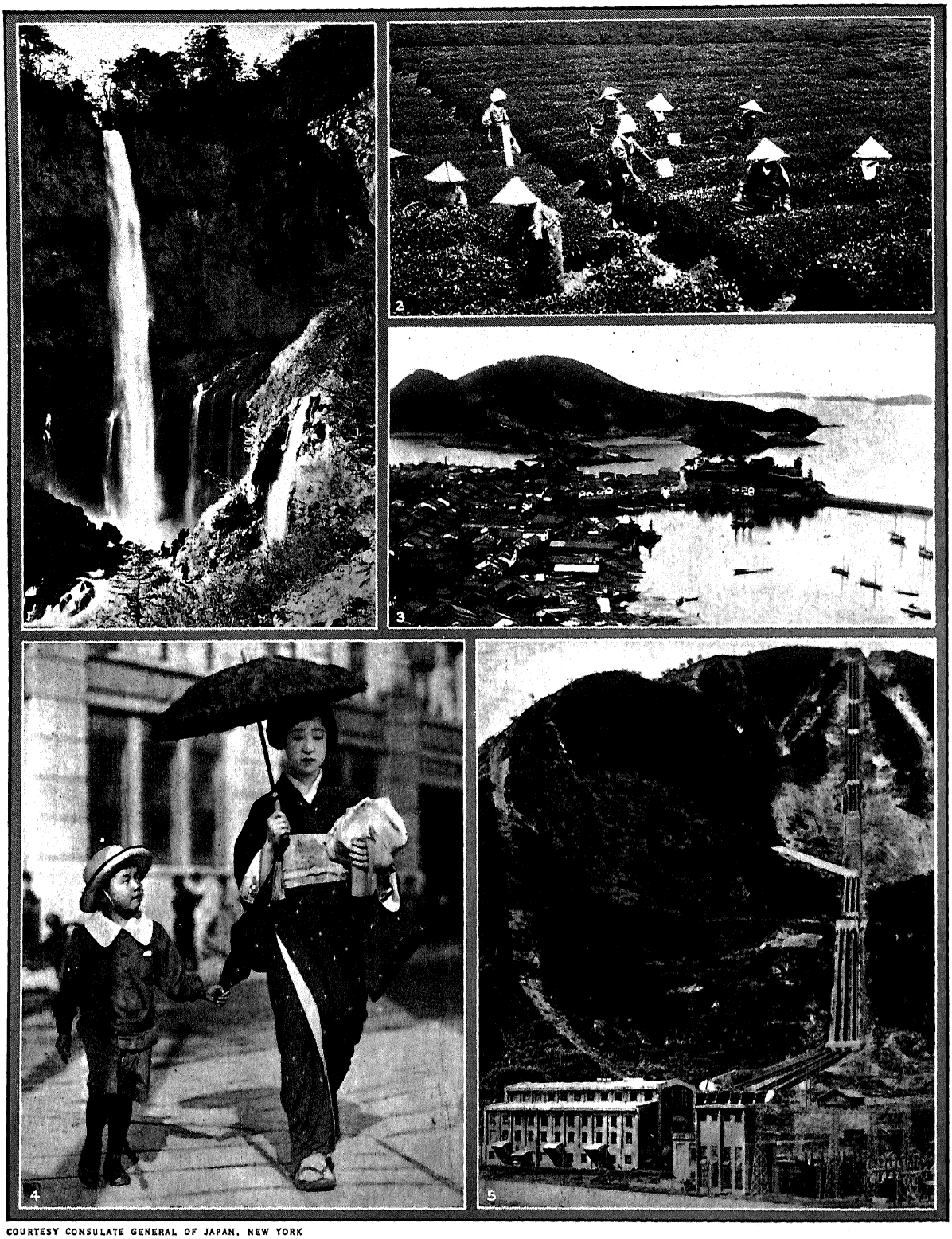
1. Panoramic view of the harbor of Kobe. 2. Mitsubishi dockyard in Nagasaki. 3. Silk testing laboratory in Yokohama. 4. Mitsubishi shipbuilding plant at Kobe. 5. One of the largest cotton mills in Tokyo with its forest of machines.



COURTESY CONSULATE GENERAL OF JAPAN, NEW YORK

MODERN METROPOLITAN JAPAN

1. Entrance gate to the Imperial Palace, Tokyo. 2. The City Hall of Tokyo. 3. Osaka—a city of rivers and canals. 4. Central meeting house at Osaka. 5. The Imperial Hotel, one of the largest hotels in Tokyo.



COURTESY CONSULATE GENERAL OF JAPAN, NEW YORK

QUAINT AND PICTURESQUE JAPAN

1. "Kegon," a waterfall at Nikko. 2. Picking tea leaves near Shizuoka. 3. "Seto-Naikai," inland sea of Japan. 4. Japanese woman in street dress. 5. Shin-Etsu, hydroelectric power station.

JAPAN

Area 261,832 sq. m.
Pop. . . . 88,584,502

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)

Pop.—Thousands

51 Akita. . . . . D 22
50 Amagasaki . . . . . M 13
77 Aomori. B 24, H 12
49 Chiba. . . . M 21
64 Fukui. . . . . N 4
228 Fukuoka. M 4
46 Fukushima. I 22
90 Gifu . . . . . L 15
52 Hachioji . M 20
197 HakodateH 12
109 Hamamatsu . . . . . N 17
62 Himeji . . . M 12
43 Hirosaki . . . . . C 23, H 12
270 Hiroshima. L 8
137 KagoshimaQ 3
157 Kanazawa J 15
53 Kiriu . . . . . K 20
788 Kobé. . . . M 12
97 Kochi. . . . . O 9
79 Kofu. . . . . L 18
88 Kokura. . . . M 4
164 Kumamoto O 4
190 Kure . . . . . M 8
83 Kurume. . . . N 4
52 Kushiro. . . G 14
765 Kyoto . . . M 13
85 Maebashi. K 19
72 Matsumotu . . . . . K 18
82 Matsuyama . . . . . N 8
51 Mito. . . . . K 22
108 Moji. . . . . M 5
62 Morioka. . E 24
56 Mororan. . G 12
74 Nagano. . . . J 18
58 Nagaoka. . . I 19
204 Nagasaki. N 2
907 Nagoya. . M 15
61 Naha. . . . . E 12
53 Nara . . . . . M 13
125 Niigata. . H 20
57 Oita. . . . . N 5
139 Okayama. L 10
66 Okazaki. . M 16
2454 Osaka. . M 13
145 Otaru. . . . F 12
46 Saga. . . . . N 3
120 Sakai. . . . M 13
169 Sapporo. . G 12
133 Sasebo. . . M 2
190 Sendai. . . H 23
99 Shimonoseki . . . . . M 5
136 Shizuoka. N 18
212 Taihoku. . . F 7
90 Tainan. . . . . H 6
80 Takamatsu . . . . . M 10
52 Takaoka. . . J 16
60 Takasaki. . K 19
91 Tokushima . . . . . N 11
2071 Tokyo. . M 20
75 Toyama. . . J 17
99 Toyohashi . . . . . M 16
56 Tsu. . . . . M 14
81 Utsunomiya . . . . . K 21
57 Wakamatsu . . . . . I 21
117 Wakayama . . . . . N 12
63 Yamagata. H 22
52 Yokkaichi. M 15
620 Yokohama . . . . . M 20
110 Yokosuka N 17
45 Yonezawa. H 22

TAIWAN (FORMOSA)

Area. 13,836 sq. m.
Pop. 4,337,000

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)

Pop.—Thousands

229 Taihoku. . . F 7
95 Tainan. . . . . H 6
74 Kirun (Keelung) F 7

OUTLINE MAP OF JAPAN
SCALE
0 100 200 300 400 500
575 Statute Miles to one inch.

TAIWAN (FORMOSA) AND RYUKYU ISLANDS
SCALE
0 25 50 100 150
173 Statute Miles to one inch.

HOKKAIDO (YEZO) AND CHISHIMA (KURIL IS.)
SCALE
0 50 100 150 200
190 Statute Miles to one inch.

RAND McNALLY
POPULAR MAP OF
JAPAN
SCALE 1 : 4,372,000
1 Inch = 69 Statute Miles
1 Centimeter = 43.7 Kilometers
Statute Miles
50 0 50
Kilometers
50 0 50 100
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of enterprises. The beginnings of the day, month and year were sacred to him and he was invoked by those entering upon any new mission or work. Janus is represented with a head looking both ways. The name of the month January comes from the same root as the name Janus.

JAPAN, an island empire in the north Pacific Ocean off the coast of China and Siberia. The southern point of FORMOSA (Taiwan) is due east of Hong Kong and the most northern of the Kurile Islands is a few miles off Kamchatka. Belonging to the empire is the former Kingdom of Korea (CHOSEN), on the mainland, and the southern half of the island of Sakhalin. The empire covers a total area of 260,704 sq. mi. Japan Proper occupies 147,652 sq. mi.; Korea, 85,229 sq. mi.; Formosa, 13,889 sq. mi.; the Kurile and Liuchu islands, 7,886 sq. mi.; Japanese Saghalin (Karafuto), 2,024 sq. mi. Japan has also a 99-year lease of the end of LIAOTUNG PENINSULA, 13,000 sq. mi., and holds a mandate for the Marshall, Caroline, Ladrone and Pelew islands. The principal islands of Japan Proper are the Hokkaido in the north, Honshu in the center, Kyushu in the south and Shikoku to the southeast.

Surface Features. The deeply indented coast line of Japan Proper measures 17,180 mi. The surface of the country is rough and mountainous and only about one-sixth of its total area can be cultivated. The highest mountain is FUJIYAMA, 60 mi. west of Tokyo, which rises 12,425 ft. In the island interior there are fertile valleys, fine tablelands and numerous lakes, rivers and minor streams. There is a great transverse fissure across the mainland from the Sea of Japan to the Pacific along which rises a group of volcanoes, mostly dormant or extinct. On the Pacific coast, near the Bay of Tokyo, is an earthquake zone said to average four shocks per day, with serious tremblors occurring every six or seven years. An extremely serious earthquake occurred in this region on Sept. 1, 1923. This almost completely destroyed the capital, TOKYO, the nearby port of YOKOHAMA and many other neighboring towns. The Inland Sea separates the islands of Shikoku and Kiushiu from the mainland, opening into both the Pacific Ocean and the Sea of Japan. It is 225 mi. long and 56 mi. wide with a surface expanse of 1,325 sq. mi.

Climate. The southernmost island of Japan is tropical; the northernmost sub-arctic. On the whole, the climate is favorable for agriculture. The rainfall is abundant; Tokyo receives nearly 60 in. annually. Temperatures are likewise suitable for crops and there are but few cold days throughout the winter, except in the northern parts where the winters may be severe. On the Japan Sea slopes of the mountains there are heavy snowfalls; on the Pacific slopes the Japan Current provides delightful winter weather.

Flora. The vegetation of Japan is fairly similar to that of North America. There are cherry, elm, plum, pear, oak, elder, pine, beech and chestnut trees. Oaks of large size grow in Yezo and there are extensive pine forests on many of the islands. Characteristic trees are the lacquer, the paper mulberry, the camphor and the wax tree. There are 150 species of evergreens and bamboos, sago and other palms. The chrysanthemum, camelia, wistaria and azalea are indigenous. Plants of temperate and tropical climates grow side by side, the pine, oak and beech often appearing with the tree fern, the bamboo and the banana.

Fauna. Most of the wild animals are disappearing, wild boar and wolf being practically extinct. Deer, fox, monkey, badger and bear are found in the mountain areas. Horses, cows, cats and dogs are domesticated. Birds common to Europe and North America are plentiful. There are the eagle, heron, duck, grouse, quail, snipe, hawk, crane and all kinds of domestic fowls. The mild waters surrounding the island abound in fish of great size and variety. On the northern coast are cod, halibut and herring and at certain seasons the northern rivers teem with salmon. Shellfish are plentiful.

Minerals. Except for copper, Japan is relatively poor in mineral resources. The production of coal, iron and petroleum has been developed greatly in the modern period, but the supplies from home sources are not adequate to meet the consumption needs, and substantial quantities are imported. At the present rate of production the coal resources of the country will be exhausted in another two or three decades, and the iron resources before that. Japan also has small amounts of gold, silver, tin, lead, zinc and tungsten. The production of coal has decreased steadily in recent years, 33,369,000 metric tons in 1927 as against 28,074,000 tons in 1929, according to the official figures. The production of pig iron, iron alloy, steel and steel materials has increased steadily. In 1928 the total was 2,977,000 metric tons. Of this, however, only about 80,000 tons were manufactured from ores mined in Japan, and the total production was only 71% of the consumption, the balance being made up by imports. Petroleum production in 1929 was 2,075,000 barrels as compared with imports of 13,674,000 barrels. Copper production in 1929 was 74,600 metric tons as against consumption of 69,275 tons.

Agriculture. Farming is Japan's most important industry, but the population has grown to such an extent that it has become necessary for the country to import substantial amounts of food. Rice is the principal crop, and to its cultivation more than half of the arable land is devoted. Wheat and barley and beans also are grown. In the southern parts two crops a year frequently are secured from the same field. In 1928, 7,282,000 acres were planted to rice. Substantial amounts of rice are secured from Chosen, and imports are heavy from South China and the neighboring countries. Farming is carried on not only in the fertile valleys, but on terraces which sometimes reach far up the sides of the mountains. Fertility of the soil is maintained by heavy fertilizing. Tea

and silk are the most important semi-agricultural crops.

Industry. Japan has developed industrially with remarkable rapidity, especially since the SINO-JAPANESE WAR in 1894-95. The industrial development was particularly great during the years of the Great War, when the European nations were unable to supply the usual amounts of manufactured goods to the Far Eastern markets. The most important industry in Japan is textile manufacture, chiefly in cotton. The raw materials are imported largely from the United States and India, and the finished goods are sold principally to China and India. The total number of factories in Japan is something over 55,000, and the employes total nearly 2,000,000. Of these, 19,400 factories, employing approximately a million workers, are textile mills. The capital invested in manufacturing is approximately Yen 450,000,000.

Shipbuilding and shipping are Japan's second largest industry. The total steam merchant marine of Japan at the beginning of 1930 aggregated 4,270,000 tons. In 1929, 49 steamships with a tonnage of 124,230 were launched.

Transportation and Communication. Because of the hilly nature of the country wheeled vehicles were comparatively little used in transportation in the old days. The principal means of transport were coasting junks and carrier coolies. Horses were used to a certain extent in transportation, but much more for carrying troops in war. One of the most important parts of the modernization of Japan has been the development of the railways, and the construction of many excellent roads connecting all the important cities and most of the smaller villages. In many of the cities street car lines are in operation, and in Tokyo a subway is under construction. The automobile, also, in recent years, has come to be used widely, both in the cities and for interurban transport of passengers and freight. In order to save railway construction costs, especially as considerable cutting was necessary to get the lines through and over the mountains, the Japanese railways were built with a narrow gauge. The demand for railway service, however, has grown so rapidly that plans now are being made to rebuild railways on the standard gauge, a very important improvement. Plans also are being carried out for the electrification of the railways, using power developed from the many mountain streams, and for the construction of a tunnel under the Shimonoskei Straits, to provide direct rail communication between the main island and the southern island of Kiushiu. Japan in 1929 had a little over 12,000 mi. of railways, of which 8,500 mi. were government owned and the rest in private hands. Modern telegraphic communications have been established throughout Japan, as well as communication by cable and radio with other parts of the Empire and the world. Modern postal service also has been established.

Foreign Trade. Japan's foreign trade has grown steadily. In 1929 imports totaled Yen 2,216,000,000, and exports Yen 2,149,000,000. The trade with the United States forms a larger proportion of the total trade than that with any other country, with China coming second, something over 40% and 25% respectively. The chief exports are silk, tea, cotton piece goods and yarns, machinery and various agricultural products. Imports include rice, wheat and beans, cotton, wool, coal, iron and machinery. Yokohama, OSAKA and KOBE are the principal ports, though foreign trade is carried on through a total of 41 ports.

Government. Until 1890 Japan was in theory an absolute monarchy, ruled by an emperor who was a direct descendant of the founder of the empire. From the 10th century until the middle of the 19th century, however, the actual control was in the hands of a succession of military chieftains who came to be known as Shoguns. In 1868 the Shogun voluntarily restored to the emperor actual as well as nominal control of the country, so that there might be a unified government to lead in the modernization of the country. In 1881 an imperial edict was issued promising the creation of a parliamentary government ten years later. The first diet met in 1890. Since that time there has been a steady tendency toward the development of parliamentary practice, which is giving the real control to a cabinet responsible to the lower house of the diet.

Under the terms of the constitution promulgated by the emperor, the emperor retains the final veto over the actions of the diet and the cabinet. This veto never has been exercised, however, care being taken in the case of important questions of policy to insure agreement before formal action by the diet. The army and the navy, both represented in the cabinet, are directly responsible to the emperor, and thus to a large extent are independent of the civil administration. The emperor's most important advisory body is the privy council. The diet is divided into two chambers, the house of peers, with 402 members, half of whom are appointed by the emperor, the other half sitting in the house by hereditary right, and the house of representatives, with 466 elected members. The cabinet, which is appointed by the emperor, theoretically is responsible to him rather than to the diet, but in recent years the practice has been established of making the cabinet representative of the majority party in the house of representatives. The party government principle was followed in the choice of the Inukai Cabinet, December 10, 1931.

Local administration is carried on through a succession of prefectures, municipal, town and village units. Each unit has a head and an advisory council and assembly. The governors of the prefectures and the heads of the municipalities are appointed by the cabinet; the heads of the smaller units are appointed by the prefectual government. The members of the local assemblies are elected. All males over 25 were given the franchise in 1925. Modern judicial procedure has been developed in Japan over a series of years. The judges are appointed for life or during

good behavior. There is a special system of administrative courts for dealing with offenses by the officials. The jury system was introduced in 1928.

Finance. Under the Japanese constitution the governmental finances are placed on a budgetary basis. In case the new budget for any year is not agreed upon by the cabinet and the diet, the budget for the previous year is automatically repeated. The budget for 1930-31 called for a total expenditure of Yen 1,609,000,000, which was a decrease of Yen 144,000,000 from the preceding year. Of these expenditures 28% were allocated for national expense, 17% for loans, and 40% for administration. The national debt stood at Yen 5,906,000,000 at the end of 1929.

Taxes in Japan are very high, and are levied upon practically every possible source of income. These taxes fall into several categories, such as those for local purposes, for provincial administration and for national purposes. Japan has a high import tariff, partly for revenue and partly for protection of her industries. The official Bank of Japan acts as the fiscal agent of the government.

Religion. Japan's political system has a religious foundation. The imperial line traces its ancestry directly back to the first Emperor Jimmu Tenno, who is supposed to have founded the empire in 660 B.C. Jimmu himself is supposed to have been the direct descendant of the Sun Goddess. The Japanese Islands, according to traditional belief, were made by the gods for the special benefit of the Japanese people, and the people themselves are the special creations and favorites of the gods. These primitive beliefs are the basis for the semi-official Shinto religion (*see* SHINTOISM), which is in effect a refined form of ancestor worship, mixed, in the case of the common people, with more or less animism.

BUDDHISM, the second great religion of Japan, came into the country directly from China and through Korea as part of the importation of art, literature and more refined civilization generally, beginning, roughly, in the 8th and 9th centuries. There is no fundamental conflict between Buddhism and Shintoism, and for a period the two religions were merged in Japan, but in the 19th century an effort was made to "purify" Shintoism by eliminating the Buddhist additions. To-day the two religions officially are completely separate. Christianity was first introduced into Japan by Franciscan and Dominican monks in the early 17th century. It was suppressed and many who refused to recant were executed at the time of the closing of Japan in the middle of that century. Christianity was reintroduced after the opening of the country in the 19th century, and since that time it has developed into an important factor in Japanese life. All important branches of Christianity are represented in Japan. There are now approximately 112,000 Shinto shrines and temples, 71,000 Buddhist shrines and temples, and 1,800 Christian churches.

Education. In pre-modern times, education in Japan was confined to the priests and the upper ranks in the military hierarchy, although specially brilliant commoners sometimes were given an opportunity to acquire learning. The education consisted almost entirely of study of the Chinese classics and of certain Buddhist and Shinto religious books. Leaders in the modernization of Japan took early steps to develop education along modern lines. A school system was worked out on the basis of American and German practices, starting with the primary schools and the kindergarten, and continuing through universities, which provided ordinary college and post-graduate work. Primary education was made compulsory for all girls, as well as boys, with the result that to-day the percentage of illiteracy in the country is extremely small, probably not over 2%. In the earlier years of the development of modern education, teachers and advisers from western countries were employed in fairly large numbers. More recently, as better trained Japanese have developed, the number of foreigners in the educational system has been reduced. The subjects covered in the schools, from the primary grades through the universities, are roughly the same as those in western schools. During the year ending March 31, 1928, the school enrollment in Japan was a little over 12,000,000, or nearly 19% of the total population. The educational system comes under the general supervision of the ministry of public instruction which spent in 1930 approximately Yen 145,000,000. In addition to the government schools there are a number of private schools of various kinds and grades. English is taught as a compulsory study in all the secondary schools, and the university students are all required to be fairly familiar with this language.

Population. Japan's population at the beginning of the modern period, 1868, was approximately 25,000,000; the population of Japan Proper in 1930 was 64,450,005. In that same year the population of the Japanese empire, including Chosen, Formosa, etc., was 90,395,698. Estimates of population at the end of 1931 put Japan Proper at a little over 65,000,000, and the Japanese empire at a little over 91,000,000. In relation to the amount of arable land in Japan the country is extremely thickly populated, more so than any other country in the world. The estimate of inhabitants per square kilometer of cultivated land is put by Japanese authorities at 969 for Japan as compared with 394 for Belgium, 305 for Italy and 226 for England. Approximately 56% of the people live in cities of 2,000 or over. There are in Japan about 35,000 foreigners of all nationalities, of whom 26,000 are Chinese, 2,000 British, 2,000 Americans and 1,500 Russians. Japanese residents abroad at the end of 1930 totaled 518,865. Of these 120,587 were living in Asia and 124,861 in Australasia. On the North American continent there were 127,609, on the South American, 142,276. The number of Japanese in Europe reached a total of 3,463. G. C.

JAPAN, HISTORY OF. Japan in the early days was an immigrant country. The land was open on all sides, inviting the influx of Asiatic and Oceanic

tribes by way of the Kurile Islands, the Korean Peninsula and Kyushu. Among the early arrivals were the Yemishi (modern Ainu) in the north, the Izumo in the west, and the Kumaso in the south. The Yamato group which was destined to rule the country was the latest to arrive. Modern historians date it as being nearly contemporaneous with the dawn of the Christian Era. The chroniclers of Old Japan, however, ascribe mythological significance to the origin of the new race. According to them, Japan is a land of divine creation which was foredoomed to be ruled by a single lineal descendant of Amaterasu, the Sun Goddess. The conquest of the inland districts and the assumption of the rule by the first emperor, Jimmu, in 660 B.C. is said to be the fulfillment of the divine ordinance.

The chronicle of the four centuries which followed was one of constant warfare, not only with those occupants of the land, but also with the Koreans. The records state that the Izumo tribe was friendly to the Yamato from the outset, that Emperor Keiko made an expedition against the Kyushu group, that Prince Yamato-Dake killed the chief of the clan and pushed the northern tribe from the Fuji district to Kanto, and that Empress Jingo subdued and won the pledge of permanent devotion and annual tribute from the Korean kings. The truth of the records is yet to be ascertained. It is significant, however, that the racial contact of different tribes resulted in the formation of three distinctive traditions of the Japanese history: the maritime, mercantile and imperialistic Japan in the south; the agricultural, physiocratic and warrior Japan of the north; the cultured civilized Japan of the west, the region most directly in contact with Korea and China.

Beginning of Authentic History. The early 5th century, in which the authentic history of Japan begins, found the Yamato already in control, not only of the inland districts and the greater part of the island of Kyushu, but, also, of the Fuji and Kanto regions in the center of the mainland. The Korean influence was much in evidence. The relationship with the Chinese Empire was also attracting the attention of the court. At the outset, the Yamato court was a mere tribal government, with the Mikado as its titular head, and under him a few hereditary functionaries, religious and military, attending to the affairs of the state. This primitive form of government was found inadequate in the face of various developments both at home and abroad. The conflicting interests of the clans and alien colonies, fast growing in number and size, waited adjustment; the widening sphere of influence in the north as well as in the south needed protection; the increasing importance of the diplomatic transactions with the Korean and the Chinese Courts was also realized. The necessity for the reorganization of the Court was imperative.

Acceptance of Buddhism. The new era opens in the middle of the 6th century, with the country divided on the question of introducing Buddhism to the court. The progressiveness of the Soga group won over the conservatism of the Monobe. This was only the beginning, however, of a long opposition of two different sets of ideas: the old principle of imperial prerogative by birthright, and the merit system of the new cult. The 17-article constitution of Prince Shotoku, proclaimed in 604, was a progressive step. The great reformation of 654 carried out by Tenchi, by far the most important reconstruction measure of the period, was a triumph for the conservatives. The most important features of this reformation were the recognition and the restoration of the Mikado's power, the nationalization of the land, and the introduction of a taxation system to safeguard the throne. Increase of the administrative machinery and the reorganization of local governments were also provided for. The historical importance of this reformation may be realized from the fact that the first stable government under the Fujiwara regency, and also the constitutional monarchy of modern Japan, were founded upon the same principle. But the progressives continued their opposition. The throne under the successors of Temmu was in constant danger. A crisis was reached in 769 when Empress Shotoku expressed her willingness to forsake the throne in favor of a certain ecclesiastical minister. The revolution was barely averted when Fujiwara Monokawa, an inveterate conservative, prevailed upon the court to adopt, once for all, the principle of imperial succession by inheritance.

Throughout the period, cultural development through the introduction of ideas from China was going on at the court. The cosmopolitan and aesthetic civilization of the Tang dynasty, then at its zenith in China, enthralled the imagination of the adolescent nation. The new capital at Nara was built on the model of the Chinese capital at Sian. Architecture, sculpture, literature and education, all followed the Chinese prototypes. The colossal statue of the Buddha stands even to this day, a monument to the exoticism of the bygone days.

The Fujiwara Ascendancy. With Tenchi's descendant again on the throne, and the Fujiwaras at the helm of the Government, a new chapter of the Japanese history opens. The third period of Japanese history, 794-1159, known as the Fujiwara Ascendancy, with Kyoto as the capital, presents a striking contrast to the preceding epoch. During the long reign of peace, the nominal supremacy of the imperial family was never questioned. No empress occupied the throne, as had several in the Nara period, and the court life moved smoothly and peacefully under the astute management of Fujiwara aristocracy. Starting as religious functionaries, the Fujiwaras had little to show in the way of military exploits, but in the art of peaceful government they were unrivaled. Unlike the Sogas and the Buddhist prelates who attempted to seize the imperial power by intrigue, the Fujiwaras remained loyal to the throne, but contrived to wield power by forming marriage connections with the imperial family. The mothers of more than 20

emperors of that period were from the Fujiwara clan. In order to free the court from the ecclesiastic influence, they moved the capital to Kyoto. Shintoism was revived to counteract Buddhism. The royal princes were appointed as governors in distant parts of the country. Others were sent out to conquer the rebellious tribes which still held some lands in the north and the south, the captured lands being offered as the prize of conquest. They also succeeded in maintaining amicable relations with China and Korea. The adoption of Chinese ways and learning was not discouraged. Scholars in great numbers appeared at that period, and particularly in the study of Buddhism Japan went far ahead of China. The names of Saicho, Kukwai and Genshin rank high in the history of Japanese Buddhism.

It is interesting to note that ladies played a prominent part in the life of the court. The court ladies who surrounded the imperial consorts were highly intelligent and cultured. They vied with each other in the game of love and poetry. The story of Genji by Lady Murasaki and the diaries of other ladies are the eternal reminder of the aestheticism of the age.

The decline of the Fujiwaras was caused by their growing decadence and internal frictions which became inevitable with the growth of new branches in the family. At times their quarrels become so acute that they had to fall back upon the support of the Bushis, the warlike clans of the north, and thus, to the latter went a lion's share of power. Bushiocracy means the rule of the Bushis or "men in arms." After the reign of the Fujiwaras, Japan remained under their control for more than seven centuries. First came the Gempei, 1159-99, then the Hojo regency, 1199-1333, followed by the Ashikaga Shogunate, 1333-1603, and the Tokugawa Feudalism, 1603-1868.

The Bushis. Even in the heyday of Fujiwara Ascendancy, there was still a group, the Yemishi, in the mountainous districts of northern Japan who held in defiance the authority of the Kyoto rule. Expeditions had to be dispatched; for many centuries guards were kept in constant vigilance over the rebellious tribe. Through constant contact with barbarism and the wild life of the north, there came into prominence the warlike clan, the Bushis, of crude temperament and frontier spirit. The Taira and the Minamoto were representatives of these rough breeds. Later they were employed as the court guards, and witnessed the fast-decaying glory of the Fujiwaras. The Taira clan was the first to snatch the power, under the leadership of the wiry Kiyomori. But Kiyomori followed to his downfall his predecessors in the pursuit of ease and luxury. In 1192 Yorimoto Minamoto became the first Shogun, or military dictator, and a new seat of government was established in Kamakura. Soon its power fell into the hands of the Hojo, who proceeded to rule the country in the name of the regency. It was a true Bushiocracy, or rule by warriors. The disastrous failure of the attempted Mongol invasions of 1274 and 1281 is credited to the Hojo's indomitable spirit and their severe discipline. With the rise of Bushiocracy, the religious life of the nation underwent a complete change. Instead of the ritualistic Shingon and the scholastic Tendai Buddhist sects of the Fujiwara period, there appeared much sterner and more direct forms of faith, such as Zen, Jodo and Nichiren. Their creed was strongly iconoclastic, revolutionary and pragmatic. They defied authority and conformity, and stressed self-control and will-power. The exile of the emperor which took place in 1221 was hardly conceivable under a less stern doctrine. The Kyoto court became a mere shadow of its former grandeur, the imperial family and the Fujiwaras clinging together to save themselves from utter oblivion. To defy the authority of Kamakura meant exile.

However, after the Mongol invasion of 1281, the Japanese became suddenly aware of themselves as a nation. This consciousness of nationalism on the part of the people necessarily weakened the Hojo supremacy. Emperor Godaigo was on the throne at this time, waiting for the opportunity to restore the imperial prerogative. Southern Japan rallied to his aid; the Ashikagas and the Nittas in the north also took arms against the Hojo. Kamakura fell in 1332 before the onslaught of the royalists.

The Ashikaga Shogunate. The power thus seized from the Hojo, however, did not remain long in the hands of the emperor. A Shogunate was re-established, and Takauji became the first of the Ashikaga Shoguns in Kyoto. The government of the Ashikaga proved the most vulnerable that Japan had yet seen. During its existence of nearly three centuries, Japan was caught up in the tornado of decentralization.

The day of physiocratic economy was over, at least in southwestern Japan, there being no more land that could be stripped from the barbarous tribes. The only additional source of revenue for the new Government was commerce. The Asiatic continent and the South Sea Islands offered outlet for Japanese goods, and before long there was a regular commercial intercourse among them. Zen priests acted as advisers in the new enterprise, and the Government began to dispatch Buddhist Temple boats to China at regular intervals. With the wealth accumulated in this way, the Ashikaga built the famous Golden Dome and Silver Dome, which to this day remain the most beautiful specimens of Japanese architecture. Paintings of that period savor of symbolism.

Reorganization of Country. The Ashikaga era is justly called the Ge-Koku-Jo, or "the lower getting the upper hand of the higher," because everyone seemed to have had his mind keyed to one object, personal gain, and was ready to go any length to get it. Assassination, intrigue and usurpation of power were common. And in the beginning of the 15th century the country was torn into innumerable provinces, each hostile to the others. It was in the midst of this self-aggrandizement and national chaos that the Portuguese arrived in Japan, 1542, bringing

with them firearms. In 1584 Spaniards reached Kyushu and opened negotiation for commerce. There loomed a new menace to the nation. To deal effectively with it, the country must show a united front. No one was more convinced of this truth than Nobunaga, Hideyoshi and Iyeyasu. The hero-worship of the Japanese is built around this trio of great men. Nobunaga's rise was meteoric. Impatient and impetuous, he struck opposition like a thunderbolt, and, in less than 20 years, he brought under his control every province extending from Owari to Kyoto. In 1573 he was created a military dictator at Kyoto in place of Ashikaga, only to die an abrupt death.

Hideyoshi then took up the work of unification just where it was dropped by Nobunaga, and made short work of this process, by quick action, adroit negotiation and generous compromises. He then turned his attention to foreign expansion. Two expeditions were made to Korea to subdue the Ming dynasty. He also conceived a plan to annex the Philippine Islands to his domain. He was a personification of the imperialistic Japan, championing the cause of expansion to the west and south. Trade was opened, settlements and colonies established, the vanguards of this overseas exploitation reaching as far as Annam, Siam and the Malayan and the Oceanic archipelagoes. The failure of his continental expedition and his death in 1598, however, were followed by a drastic change in the nation's attitude. The national finances had been taxed to the limit.

The Tokugawa Era. Iyeyasu, a born conservative, could not but reverse the imperialistic policy of his predecessor. "Little Japan" on the basis of strict economy was his program. The closed door policy proclaimed in 1636 under his grandson, Iyemitsu, was, in a way, a logical outcome of this negative attitude. Installed as Shogun in 1603 at Yedo (Tokyo), Iyeyasu set out to reorganize the country. He was a northerner in temperament, with a strong leaning toward physiocracy in his economic faith. A man of unabated energy, scrupulous deliberation and elaborate plans, he brought the country under an intricate system of iron-clad feudalism. The relation of the throne and the Shogunate paralleled that under the Kamakura Shogun; the Shogun at Yedo was the absolute ruler, the court at Kyoto having authority in theory only. Under the Shogun came 5 Renshi, or feudal lords, who were immediate relatives of Iyeyasu; 78 Fudai, or hereditary retainers, usually their distant relatives; 114 Tosamas, each enjoying a degree of local autonomy, though restricted by the central policy of thrift and stringent economy. That a nation with such variegated elements and diverse traditions was finally made into a compact political unity is a tribute to the organizing genius of Iyeyasu. Peace was established and prosperity returned. The magnificent Nikko Shrine was built in honor of Iyeyasu. Education was encouraged, the Sung system of Chinese philosophy being adopted as official doctrine. Poets and historians came into prominence; painting and other arts gained patronage. The stern and simple habit of life rapidly gave way to the ease and comforts of peace.



COURTESY METROPOLITAN MUSEUM OF ART

PROCESSION OF THE EMPEROR AND HIS SUITE (1626)
Kano School makimono, or scroll, on paper tinted by hand

In spite of the pronounced policy of the closed door, mercantile enterprises continued, and internal commerce developed rapidly. Cities and towns grew up. Such seaports as Osaka, Hakata, Niigata, Shimonoseki and Ishinomaki enjoyed unprecedented prosperity. Even the Jokas, or local headquarters of military magnates, became the market centers. With the growth of the cities and the prosperity of the nation there came into existence a new class of people, the merchant. During the more than 250 years of the peaceful Tokugawa's régime, this class came to control the wealth of the nation and became more and more powerful. Dramas, poetry, novels, paintings of this period, all bear witness to the growing importance of the middle class.

Demoralization and decadence of the Samurai amidst extravagance and leisure slowly paved the way for the downfall of the Tokugawa régime. Political annals show that at many different times, Yoshimune, Hakuseki and Sadatune took measures to preserve the integrity of the Samurai class. Before the prevailing tendencies of the time, however, the Tokugawa family was helpless. The ease and luxury in which the Shoguns indulged, and the reckless expenditure of money reduced the finances of the Shogunate to a state of bankruptcy. The revenue of the Shogunate was derived, not from tax-levies on the feudal lords, but from the income from the private properties of the Tokugawa family, and private resources have limits. The need for economic change was palpable when in 1727 Ohka Tadasuke took steps to organize in Osaka a rice exchange office. When Yamagata and Takeuchi, two royalists, were tried and executed for conspiracy, unrest among the people became more obvious. In 1833 Ohshio Haehachi resorted to direct action in connection with the salvation of the poor during the Tempo famine. The intellectual group, students of history and neo-Shintoists joined hands with the malcontents in condemning the existing government, and in advocating the return of the country to the Imperial rule.

Such was the state of affairs in Japan when Com-

MODORE MATTHEW C. PERRY made his appearance in Japanese waters in 1853. The Shogunate could not insist on maintaining its policy of national isolation in the circumstances. The alarm of Western invasion was sounded throughout the nation. Fear for national safety heightened national consciousness. Treaties of commerce and navigation were concluded, first with the United States of America in 1858, then with the European powers, much against the will of the people. Extraterritorial rights in due course were yielded to foreigners. The feudal lords of southern Japan who had long been under the suspicious surveillance of the Shogunate, united their forces with the throne to resist the Tokugawas. The country must stand or fall as a united nation with its legitimate ruler at its helm, they insisted. The Shogunate, decadent, bankrupt and torn by internal dissension, had to accept the logic of the circumstances. With the Restoration in 1868 a new chapter of modern Japan opened.

Modern Japan. The history of modern Japan is in itself an integral part of world history. From the Japanese point of view, it was another great transformation, with Western civilization as the model for reconstruction. The chief aim of the nation was simply to keep the country intact and bring it up to equal footing with other powers. The army was reorganized on the basis of universal conscription; a modern navy was built; a new system of finance was based on taxation. A national system of compulsory education was adopted. The constitution, modelled on that of Germany, was proclaimed in 1889 providing for a parliament of two chambers. The first parliament was summoned in 1890.

The first test of New Japan came in the Sino-Japanese War in 1894-5. Japan's victory and her progress toward modernization brought about the revision of the treaties with the Western Powers. An alliance was entered into with Great Britain in 1902. The victorious war against Russia in 1904-5 gained for Japan a place in the family of nations. The World War found Japan on the side of the Allies, fighting to dislodge Germany from her stronghold in Shantung, China, and to make herself sole custodian of Asia's eastern waters and of the Pacific. During the Paris Peace Conference Japan shared the victor's chair, and in the Council of the League of Nations she stands as one of the Big Four. At the Washington Naval Conference in 1922 and the London Naval Conference, eight years later, full recognition was given to her position as a world naval power next only to the United States and Great Britain.

R. T.

Relations with China. Japan's serious lack of coal and iron and other natural resources as a foundation for industrial life and development compelled her to turn to outside sources for these supplies. As her industry developed she found it necessary to look beyond her own borders for markets for the products of her factories. For both raw materials and markets she turned naturally to China, and a serious conflict developed within Japan itself over the question of the method to be used in satisfying Japan's needs. The military party took the line that Japan must get control of China, not only to protect herself but to obtain markets and raw materials. Under the domination of this party Japan waged the war with China in 1894-5 and with Russia in 1904-5. The same party led the movement which resulted in the annexation of Korea in 1910, the seizure of the German rights in Shantung in 1914, the presentation of "the twenty-one demands" in 1915, and the adoption of what usually was called "a strong policy." The civilian leaders argued that the only way in which Japan could secure permanent access to the markets and raw materials which she needed in China was to win the friendship of the Chinese people.

In the inevitable domestic conflict over the policy towards China, the power of the civilians slowly increased with the development of parliamentary government, newspapers, and other means of expression of public opinion. The excessively high taxes and the cost of the military establishment also turned feeling against the military as did the almost ruinous effects of the anti-Japanese economic boycott by the Chinese in 1919 and 1920.

The military occupation of Manchuria in the fall of 1931 by the Japanese was due in part to gradually developing friction between the Chinese and Japanese over their respective rights and interests in that area. A very important contributing factor also was the desire of the military party to create a situation in Japan itself which would give them back the control of affairs which they felt slipping out of their hands. The military party secured and maintained complete supremacy in Japan, but the boycott which the Chinese promptly started was having very serious effects on Japanese industrial life well before the end of 1931. On Jan. 28, 1932, Japanese marines landed at Chapei, adjacent to the Japanese section of the International Settlement of Shanghai, and engaged in a conflict with the Chinese which lasted for 40 days in spite of the protests of the League of Nations and the World Powers. On May 5 China and Japan signed a truce agreement.

G. C.

BIBLIOGRAPHY.—K. Hara, *An Introduction to the History of Japan*, 1920; F. Brinkley, *A History of the Japanese People;* James Murdock, *A History of Japan;* Marquis S. Okuma, *Fifty Years of New Japan*, 1909; Y. Takekoshi, *The Economic Aspects of the History of the Civilization of Japan*, 1930; M. Anesaki, *History of Japanese Religion*, 1930; and Y. Takenobu, *The Year Book* (1905-1931).

JAPAN, SEA OF, an enclosed sea lying off the coast of Siberia and separated from the Pacific by the main islands of the Japanese Empire. It has an area of about 400,000 sq. mi. and a mean depth of 4,430 ft. The maximum depth is 12,180 ft. At the south it communicates with the East China Sea through Korea Strait and at the north is connected with the SEA OF OKHOTSK by La Perouse Strait.

JAPAN, SEA OF, BATTLE OF THE (May 27-28, 1905, a naval engagement in the RUSSO-JAPANESE WAR between the Russian Baltic fleet, commanded by Admiral Rozhdestvensky, and the Japanese battle-

fleet led by Vice-Admiral Togo. The Japanese fleet, which Vice-Admiral Togo had kept in home waters awaiting the Russians, stood to the east of Rozhdestvensky's fleet array. Superior handling of the Japanese fleet combined with speed resulted in annihilation of the Russian fleet within an hour, although the engagement continued sporadically for two days. The Russian loss was 26 vessels, 4,000 men and 7,000 prisoners; Japan's, only three destroyers and 670 men.

JAPAN CLOVER, a species of bush-clover (*Lespedeza striata*) native to eastern Asia, now widely naturalized in the southern states, and increasingly grown for hay and forage. Japan clover is a low, tufted, much branched annual, about 1½ ft. high, with numerous small leaflets and inconspicuous pinkish flowers borne in the leaf axils. For 1930 the Bureau of Agricultural Economics estimated the total yield of Japan clover hay in the United States at 274,000 tons.

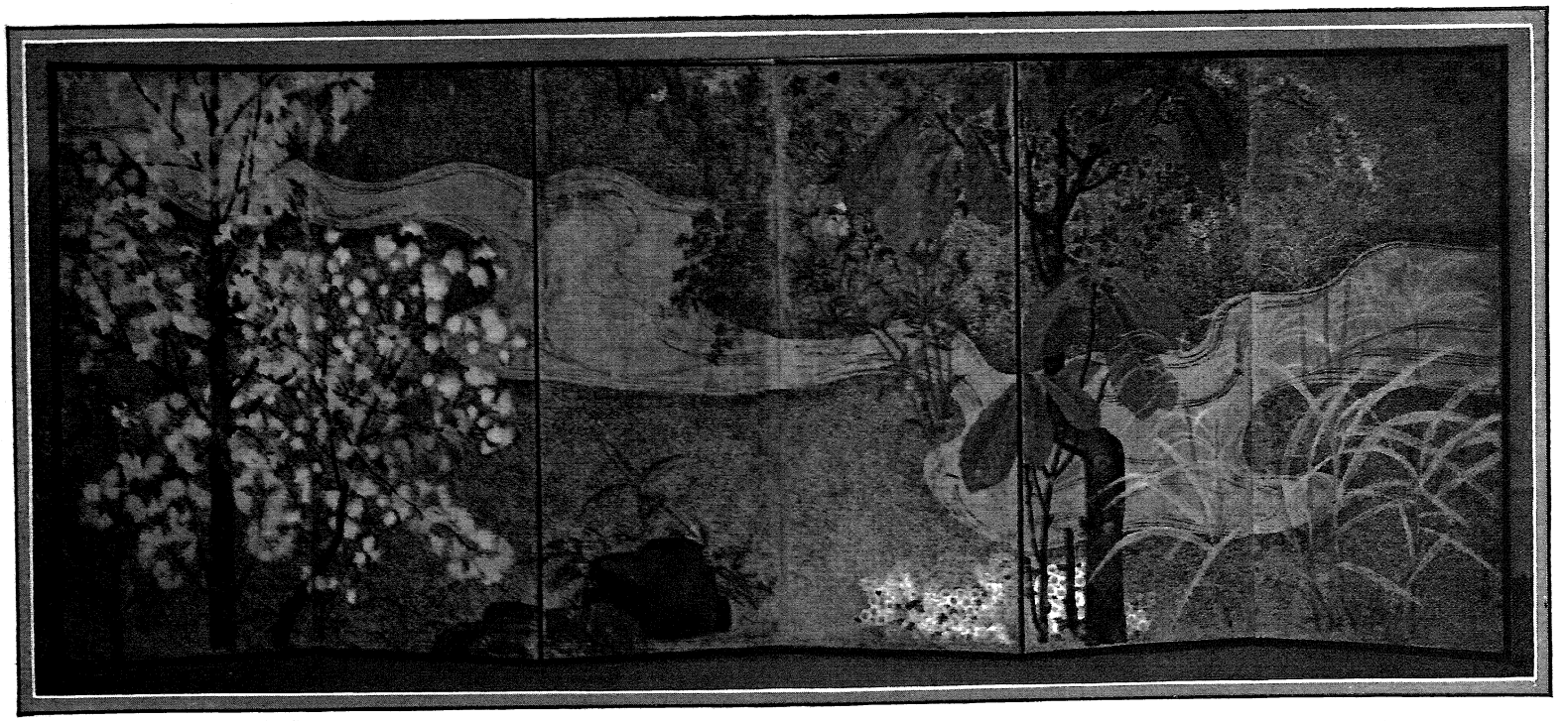
JAPAN CURRENT, a warm current of the northwest Pacific Ocean, flowing northeastward along the shores of Japan, and named Kuro Shiwo, or black stream, because of the dark color of its water. It is variable in speed and extent, probably as a result of the monsoons, and finds its origin in the general north equatorial current in the Pacific. The latter, a warm current, flows westward until it is deflected by the Philippine Islands, then turns north. During the northeast monsoon, it meets the cold water from Japan and the Yellow Sea. Both then turn eastward and run side by side for a long distance, but the difference in temperature between the two is very marked and abrupt. As soon as the northeast monsoon stops blowing, the Kuro Shiwo consists only of the north equatorial current and is much slower. Shortly afterwards, during the months of July and August, when the southwest monsoons blow with full force, the warm waters in the China Sea are blown northeastward, and, joining the north equatorial current, produce a Kuro Shiwo that is very broad, uniformly warm, and of great speed again.

JAPANESE ALPS, the mountain ranges extending from the Pacific Ocean to the Japan Sea across the widest part of the main island of Japan. The ranges contain peaks rising to approximately 10,000 ft., the highest anywhere in Japan except for FUJIYAMA. The northern end of the three groups, northern, central and southern, into which the alps are divided, are the most popular for mountain climbers, owing to their accessibility and hot springs. Mt. Hodaka, in the northern alps, with its three peaks, presents difficulties which appeal to the more adventurous.

JAPANESE - AMERICAN TREATY, 1854. Commodore Matthew C. Perry, despatched with a squadron of warships to Japan by President Fillmore, in July 1853, presented to representatives of the Emperor of Japan letters from Fillmore looking forward to an opening of diplomatic and commercial relations between Japan and the United States. Upon his return to Japan in Feb. 1854, having meanwhile visited China, on Mar. 31 Perry concluded the first treaty between the two countries. The ports of Simoda and Hakodate were constituted ports for the reception of American ships, where such ships might trade under certain temporary restrictions. American citizens in Japan were to be as free as in other countries, with certain qualifications. The Emperor bound himself to extend to the United States whatever privileges he might thereafter grant to other nations.

JAPANESE ARCHITECTURE. *See* CHINESE AND JAPANESE ARCHITECTURE.

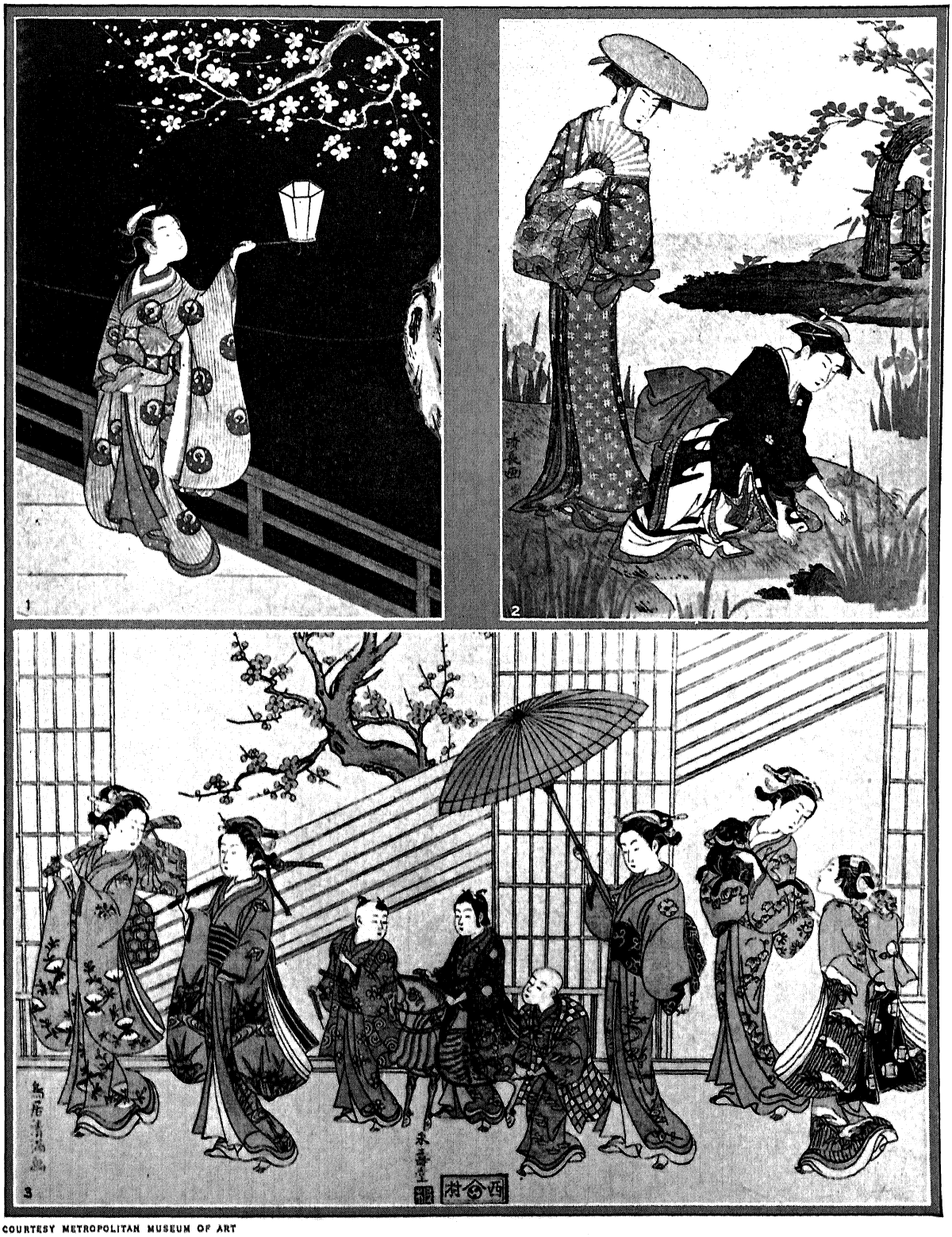
JAPANESE ART. The art of Japan derives mainly from China and Korea. When Buddhism arrived in Japan, in 552, by way of those countries, Japan needed only this spiritual incentive to quicken its creative power. In spite of the influence of the work of the more advanced Chinese, the island kingdom soon developed its own strongly individualized art. The most essentially Japanese of their artistic productions include lacquer and metal work, prints, architecture, both domestic and Shinto, and many forms of secular painting and sculpture. In Japan the art life of the people has steadily advanced throughout the ages. An innate refinement of taste demanded beautiful forms and exquisite decoration for the most ordinary necessities of life. The population has consequently developed a profound appreciation of beauty. To this may be added a passionate love of nature, and a keen recognition of the fantastic and humorous in art. From the Chinese they acquired the exalted type of Buddhistic landscape-painting known as Zen. Caligraphy being regarded by this people as one of the arts, profound study was needed both for brush-writing and for mastery of the intricacies of the Japanese characters. Power of observation and manual certainty were thus extraordinarily developed. Japanese prints, which came into prominence in the late 17th century, exhibit this training to a supreme degree. The Japanese collectors, who have always jealously guarded their national art-treasures, scorned the prints as representations of every-day life. This is therefore the one form of the country's art which can be adequately studied outside Japan. Japanese sculpture, mainly in wood, bronze and lacquer, can only be seen on its native soil. Many masterpieces have survived the temples which formerly sheltered them. Supreme among these is the 13th century bronze Amida of Kakamura, one of the most impressive statues in existence. The architecture of Japan, whether in the simpler Shinto or more elaborate Buddhistic forms, is, according to Cram, "the most perfect mode in wood the world has known." Temple sites were chosen for their imposing surroundings, and architects were invariably inspired landscape-gardeners. As metal-workers the Japanese are matchless craftsmen. The sword, the principal subject of their labors, was so deeply reverenced that a complicated ritual of purification was exacted during its fabrication. These hallowed weapons equal the famous blades of Damascus and Toledo. Japan, which gave its name to lacquer, has excelled in that



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JAPANESE MAGNOLIA SCREEN

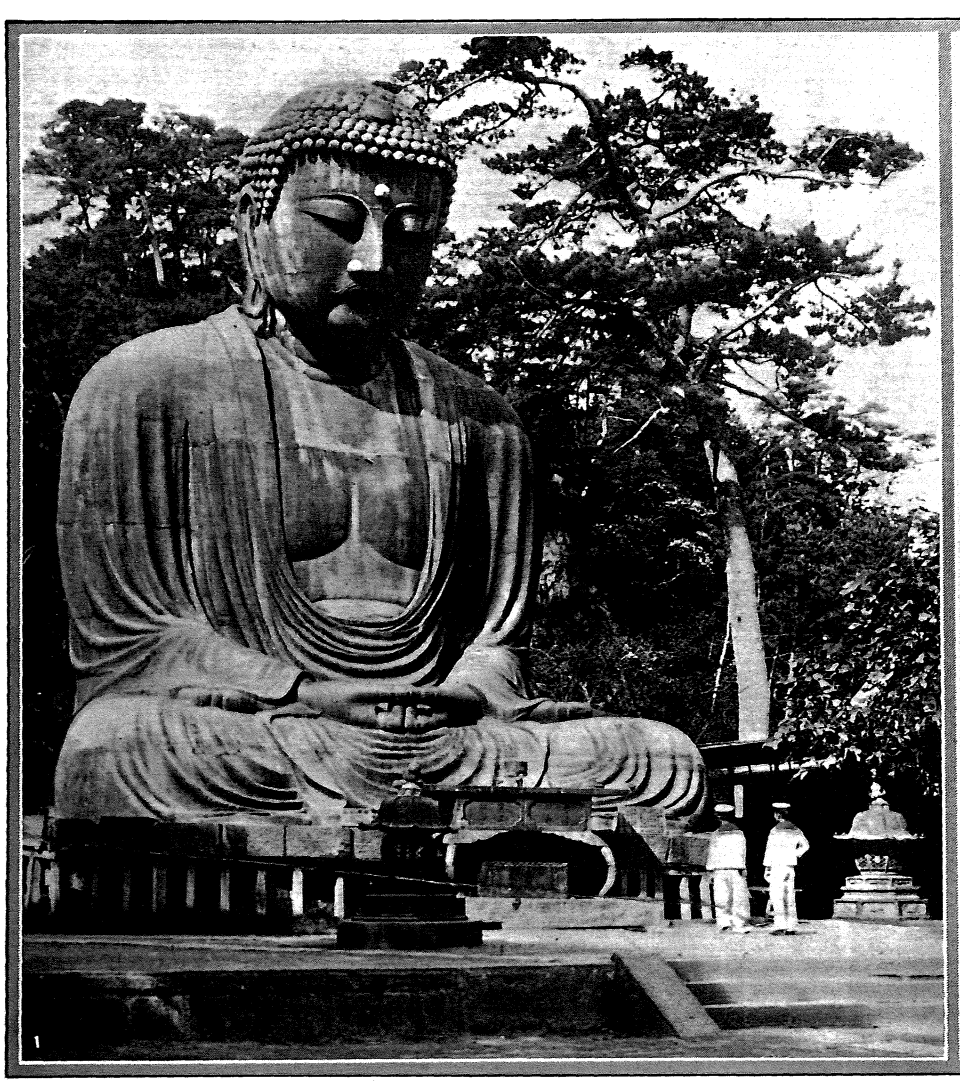
By Koyetsu Honnami (1556-1637). An example of the Japanese art of painting upon screens.

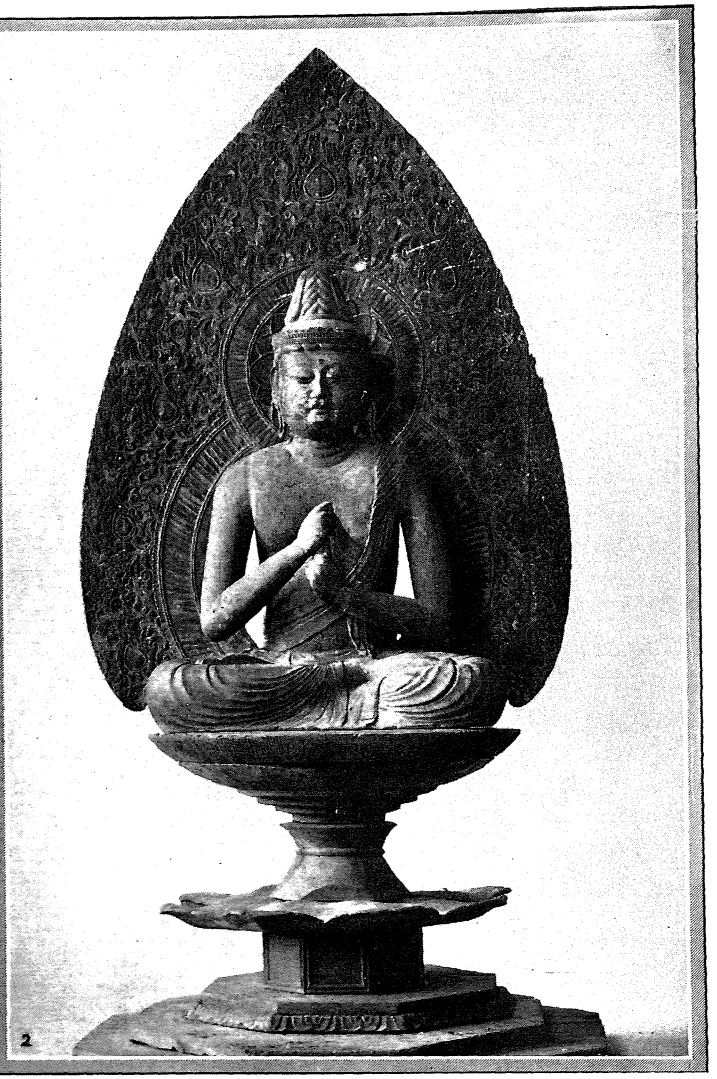


COURTESY METROPOLITAN MUSEUM OF ART

JAPANESE COLOR-PRINTS OF THE 18TH CENTURY

1. "Girl with a lantern on a Balcony," by Suzuki Harunobi (1725-70). 2. "The Iris Garden," probably the center sheet of a triptych, by Torii Kiyonaga (1752-1815). 3. "A Daimyō Procession Game," by Torii Kiyomitsu (1702-63).

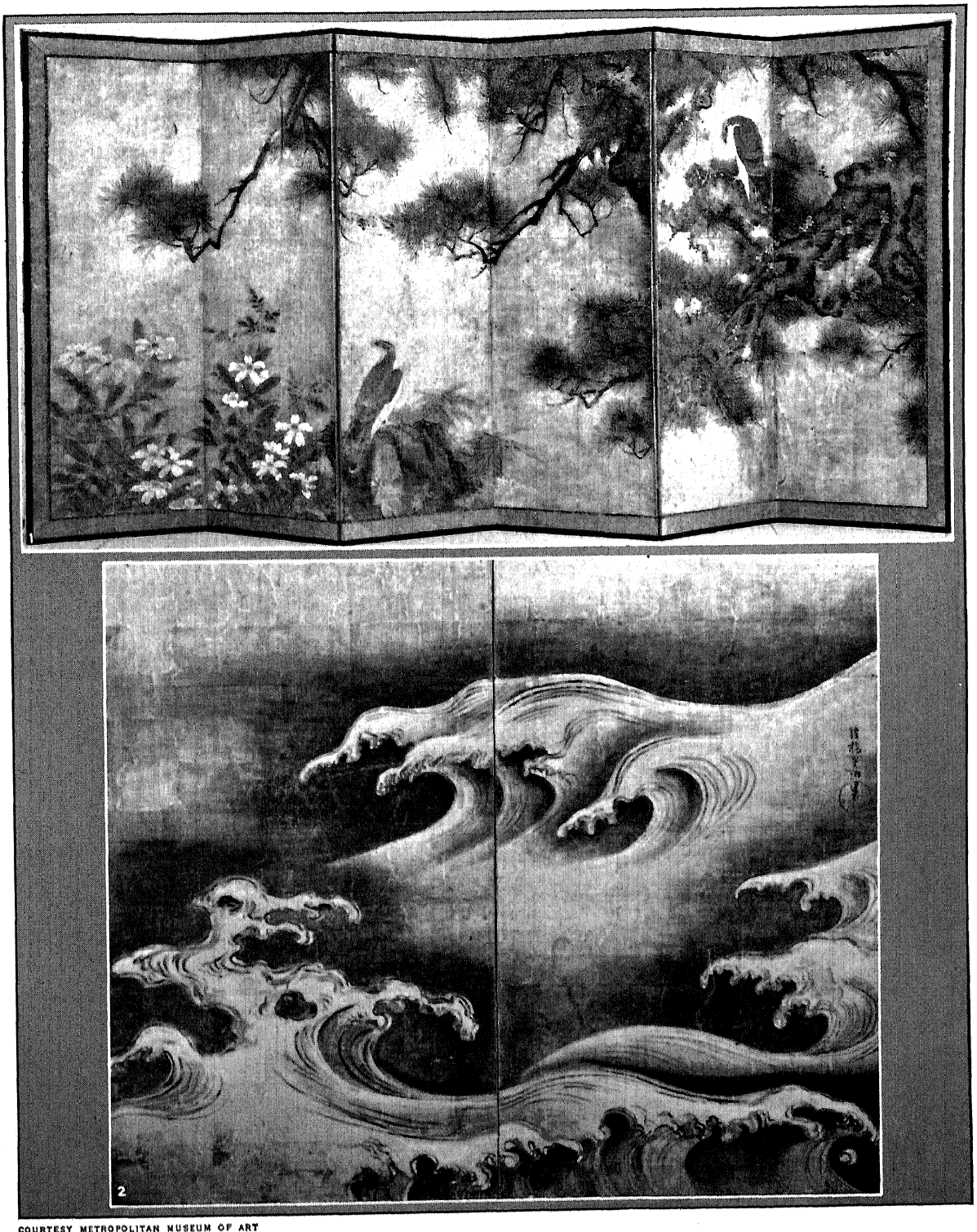




2. COURTESY METROPOLITAN MUSEUM OF ART

CELEBRATED SCULPTURES OF BUDDHA IN JAPANESE ART

1. Perhaps the best known statue of the Orient, the colossal bronze Buddha (*Amida*) of Kamakura, Japan, cast in 1252. The huge figure weighs 450 tons and measures 49 feet, 7 inches in height and 97 feet in circumference. **2.** Seated figure of *Vairocana* as Buddha, made of wood carved and lacquered. Early Fujiwara Period, about 950.



COURTESY METROPOLITAN MUSEUM OF ART

JAPANESE SCREENS

1. Six-panel screen with a design of pine trees, eagles and camellias. An example of the Ashikaga Period, 1334-1573, it is attributed to Kano Motonobu. 2. Twofold paper screen with wave design in colors on a gold ground. It was designed by Ogata Kōrin, a leading artist of the Tokugawa Period, 1603-1868.

medium. The earliest specimens of Japanese lacquer are of the 7th century, while the supreme masters of the art flourished in the 17th, 18th and 19th centuries. Such artists, and their protectors, the great nobles, sought perfection, and were indifferent alike to the amount of time and money expended on the work. The art patrons also fostered the production by their own craftsmen, and on their own looms, of matchless fabrics, miracles of design, color and weaving, such as are found in the No robes. Japanese porcelain is a successful adaption from the Chinese. Their pottery, originally influenced by Korea, has become one of the most distinctively national crafts.

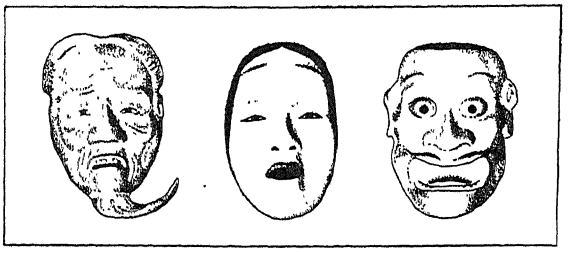
BIBLIOGRAPHY.—L. Ledoux, *Art of Japan,* 1927; J. F. Blacker, *ABC of Japanese Art,* 1930 ed.

JAPANESE BEETLE, an insect (*Popillia japonica*) native to Japan and first found in the eastern United States about 1916. It is a member of the family *Scarabæidæ*. The larvæ resemble those of May-beetles, commonly called white grubs. They feed on the roots of many kinds of plants. Pupation occurs in the ground and adult beetles emerge from June to September. They feed on foliage of fruit and shade trees and many herbaceous plants. Adults are about one-third of an inch in length. They are heavy-bodied, with rather long legs. Wings are burnished coppery red in color. Bodies are green with white markings. Arsenate of lead sprayed on foliage kills many beetles. They may also be trapped and great numbers killed in this manner. Natural enemies are being sought as a means of control. Quarantine regulations governing shipment of plants with soil on the roots aim to prevent further dispersal of this pest.

J. R. T.

JAPANESE DRAMA. In ancient times there were in Japan many primitive forms of dramatic expression, most of which centered about religious celebrations. From these various types of music and dance ceremonials, distinguished by such names as *kagura, matsuri, dengaku* and *sarugaku,* and customarily held in the vicinity of shrines, developed a distinct type of drama called the *Noh.* To Kwanami Kiyotsugu (1333-84), a Shinto priest, and to his son, Seami (1363-1444), is given the credit of having composed the earliest specimens of the *Noh.* These plays, many of which are available in good English versions, belong in the first rank of poetic drama and are unexcelled in subtlety and nobility. They were written for the educated upper class, and reflect strongly the Buddhistic thought which dominated the medieval Japanese mind. They were performed by highly trained masked male dancers, a chorus and musicians. Of approximately the same age, and employed as interludes for the *Noh,* are the *kyogen,* short realistic farces, corresponding closely to the rustic farces of medieval Europe.

At the beginning of the 17th century two types of democratic drama made their appearance in Japan. One was the puppet-play, the other came to be called *kabuki.* Both types reached their highest development in the plays of Chikamatsu Monzaemon (c. 1660-1724) and Takeda Izumo (1688-1756). The themes of both puppet-play and *kabuki* are extremely diversified, embracing historical, legendary, domestic and poetically fantastic material. Many of the earlier



MASKS OF THE "NOH" ACTORS OF TOKYO

Noh plays were popularized and elaborated into these forms. Whereas the *Noh* is a highly condensed type of drama, several complete plays being included in the same performance, the *kabuki* is usually of many acts, and in some cases requires several days for complete presentation. It makes use of all the dramatic modes, and swings from extreme realism to extreme conventionalization. For the most part, however, it leans toward what the western world calls operatic effect.

In the 20th century *kabuki* is still the standard dramatic form, though the influence of Occidental drama has manifested itself. The result is that a number of playwrights have arisen who imitate IBSEN, STRINDBERG, SHAW, O'NEILL and others. This imitative movement has thus far produced no masterpiece.

G. Hu.

BIBLIOGRAPHY.—Waley, *The No Plays of Japan,* 1922; Kincaid, *Kabuki, The Popular Stage of Japan,* 1925; Lombard, *The Japanese Drama,* 1928.

JAPANESE EXCLUSION ACTS, bills which have limited or barred Japanese immigration into the United States. After the exclusion of Chinese laborers from the United States (*see* CHINESE EXCLUSION ACTS), Japanese were brought into this country under contract labor arrangements. Many more came because of American wages, and in response to the centrifugal force of a rapidly increasing population in a restricted area. In 1900 there were some 24,000 Japanese in the United States; the actual influx began in 1903, reaching its maximum with the entry of 10,000 Japanese in 1907. Coincidentally Japanese capitalists were investing in California and Oregon enterprises.

Organized labor, political leaders and a great part of the press and public of the Pacific states demanded the exclusion of the Japanese, fear of economic competition abetting racial prejudice. In 1906 the Board of Education of San Francisco ruled that Oriental pupils be segregated in separate schools. In 1907 the United States and Japan arrived at a "gentleman's agreement" to the effect that San Francisco should admit to the common schools Oriental pupils not over 16 years of age, and that Japan would refuse passports to coolies. The agreement was frequently

evaded by Japanese "travelers" who became applicants for labor upon arrival. In 1913 the California legislature passed an Alien Land Bill aimed to prevent any Japanese from acquiring land or leasing it for more than three years. President Wilson sent Secretary of State Bryan to Sacramento to state the objections of the administration to such a discriminatory measure; but protests were ineffectual. After a fruitless exchange of notes between Japan and the United States, the issue disappeared in the mêlée of the World War.

In 1917 Alien Land Bills pending in Idaho and Oregon were dropped on the plea of the Department of State. In 1920 the anti-Japanese faction carried the state election in California, and enactments followed designed to prevent Japanese from becoming members of corporations, lessees of land, or guardians for minors of estates including property which a Japanese could not hold in his own right. Congress, in the Immigration Act of May 26, 1924, excluded aliens ineligible to citizenship, namely Japanese, Chinese and East Indians, from admission.

JAPANESE LANGUAGE, the language of Japan, perhaps best taken as constituting a distinct LINGUISTIC FAMILY, although because of its "agglutinative" character it is often regarded as connected with "Ural-Altaic" (*see* FINNO-UGRIC; TURCO-MONGOL-TUNGUS), and is also held to be related to COREAN. Such affinities are possible, and in the latter case probable, but are at best very distant. Attempts have recently been made to connect it with MALAYO-POLYNESIAN; it is scarcely related to Chinese, and its only certain kin is the language of the Riu-Kiu Islands.

Phonetically, Japanese has only open syllables; its noun is inflected by postpositives; its verb has a rich system of semi-inflection, some of its characteristics being a negative and a causative voice, the latter often used in polite language to indicate that a certain person causes an action to be performed, and the distinction between singular and plural is incomplete. Since Japan was for many centuries under the influence of Chinese civilization, its language has adopted thousands of Chinese LOAN-WORDS, and even many Chinese constructions, besides using Chinese characters in its script. To provide for the special needs of Japanese itself, a system of syllabic spelling is employed as an aid to the character-script, these *kana* signs generally representing the inflectional terminations and particles, and often being written beside a Chinese character to indicate its pronunciation. Two such systems are in use: *hiragana* and *katakana,* the former being the more popular. J. J. L. D.

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JAPANESE LITERATURE. The art of writing in Japan was introduced from Korea in 404 A.D. when Wangin brought to Japan the Confucian Analects, and One Thousand Characters, the beginner's classic of China. After the introduction of Buddhism in 552 A.D., Chinese literature became popular. Ever since the Japanese have shown themselves remarkably proficient in borrowing a literature or a culture without losing a sense of their own spirit.

Their earliest book is the *Kojiki,* or "Record of Ancient Things," telling of the creation of Old Japan, the origin of the imperial family, and the traditional and mythical history of Japan. It is in archaic form, compiled in 712 by the imperial command. Nine years later, the *Nihongi,* or "Chronicles of Japan," came out in Chinese. Both these volumes were supervised under Korean scholars in the compilation. They have no literary merit except in a few crude verses.

During the Nara period, 710-794, the *Manyoshu,* "Anthology of Myriad Leaves," was compiled. The form is known as the *tanka,* or short song, consisting of five lines, 31 syllables in all, arranged—5, 7, 5, 7, 7. There is no rhyme or accent; each line must end in one of the five vowels or n. In contrast to the *tanka,* there are *naga-uta,* or long songs, which originated in the imitation of Chinese and Korean poems, but the *naga-uta* number only 268 out of 4,515. The best known poets in the *Manyoshu* are Hitomaro and Akahito.

The *Kokinshu* or "Anthology of Ancient and Modern Odes," containing about 1,100 poems, was compiled in 905 during the Heian period, 800-1200. This was the first of the *Nijuichi Dai,* "Twenty-one Reigns," series completed in the 15th century. The arrangement of poems shows headings such as Spring, Summer, Autumn, Winter, Greetings, Joy, Sorrows, Love, Departure, Journeys, etc. Tsurayuki, one of the editors, was a leading writer of the day and the author of the *Tosa Diary.* The introduction to the *Kokinshu* shows the influence of Chinese literature; it is the reflection of the Great Preface in the *Book of Odes.* Women like Murasaki Shikibu and Sei Shonagon surpassed the men writers of their day. The former is known for her *monogatari,* or tales, and the latter for her *makura-no-soshi* or pillow-book; thus one records her utopian world, the world she would like to live in, the other, an actual life lived at court with the things she saw and thought there. The *Hojoki,* a small book by Chomei written in 1212, is considered important because of its fine style, with idyllic descriptions of country and lakeside. In 1235 Sadaiye, a noble, assembled the *Hyaku Nin Isshu,* "100 Poems by 100 Poets," which contains better *tanka* than those from the 7th to the 13th centuries. The collection, with poems memorized by every Japanese student, shows the artificial convention of Japanese poetry and its plagiarism of ideas. The *Tsur-Dzure-Gusa* is a delightful collection of sketches, anecdotes and essays by a Buddhist monk and shrewd cynic, Kenko Boshi (c. 1290-1350).

In the 15th century a new form of poetic art arose known as *no* or lyrical drama. It was closely associated with religious dances of a pantomimic character called *kagura,* in connection with Shinto ceremonies. Though it originated in Buddhism, soon the aristocratic and warrior classes of feudal Japan were practising it for entertainment.

During the Tokugawa era, 1603-1867, the Hideyoshi expedition to Korea brought back a number of books printed with movable type, and printing was started in Japan. The Chinese classics were studied in Chinese by people known as the *Kangukusha,* or scholars of Chinese classics. Chikamatsu Monzayemon (1653-1724) founded the popular theater, or *Kabuki Shibai,* and produced a number of dramas. Though he did not write anything of literary worth, his position in Japanese drama is important. Under him drama was divided into historical plays, and plays of social life and manners. His 51 plays of from 3 to 5 acts are written in prose intermixed with poetry.

Matsura Basho (1642-94), an ardent student of Buddhism and Taoism, wrote in the form of the *Hokku,* or poem of 17 syllables (5, 7, 5,) which is very popular. Under Mitsukuni, who directed the compilation of a history of Japan in Chinese, native learning was encouraged. Instead of writing in Chinese, *wagakusha,* or Japanese scholars, produced prose works in their own language.

Since the Restoration of 1868 hardly anything of real significance or quality has been produced, as one can readily see by reading such popular authors as Yone Noguchi, Yusuke Tsurumi, etc. However, quantity is not lacking, and many books appear—literary criticism, historical essays, poems, dramas and novels. Modern literature began with the introduction of Western ideas, and was marked by an importation of Anglo-Saxon literature, followed by French, German and Russian literature. In 1885, Shoyo, who was influenced by Shakespeare, wrote an essay called *The Essence of the Novel;* after this the novel became a new form of literary expression in Japan. Illustrating the point with his own novel, *The Life of Contemporary Students,* Shoyo severely criticized the old school of morality and laid down certain fundamental principles for the new school. *A Village of Wistarias* came out in Romantic vein by Toson under the influence of Swinburne and Rossetti. Akiko, another popular writer, has best preserved in her verse the Japanese spirit. Where Japanese literature will turn in future yet remains to be seen. *See also* KOREAN LITERATURE; CHINESE LITERATURE. Y. K.

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JAPANESE RIVER FEVER. *See* TROPICAL MEDICINE.

JAPHETH, in Biblical narrative the youngest son of Noah and the ancestor of one of the three groups into which the world is divided in the Book of Genesis. Shem and Ham, the other two sons, are represented as the ancestors of the Semitic and Hamitic branches of mankind; Japheth is therefore taken as the ancestor of the Aryan or Indo-European branch. Actually the descendants of Japheth appear to have included those races with whom the Hebrews had little or no ethnological or political relations, especially those on the outskirts of Palestine.

JAPHETIC, a hypothetical LINGUISTIC FAMILY supposed to include not only modern Caucasian and Basque as well as the extinct Etruscan, Elamitic, Sumerian, Hittite, etc., but also Indo-European, Finno-Ugric, Semitic, etc. (*See* these subjects under separate titles.) Through an alleged obligation to make all linguistic phenomena conform to Marxian dialectics, the concept of Japhetology has been extended to create a complete theory of the origin and development of language on a wholly theoretic sociological foundation, and it seeks to derive every form of speech from one and the same source through one and the same course of evolution everywhere. Ignoring the evidence of actual facts, and hampered by a narrow ideology which it feels compelled to defend at any cost, Japhetology proceeds by fantastic guesses. Its methods are totally lacking in scientific exactitude; and it has at best only a pathological interest as a linguistic phase of distortion of data to support a preconceived theory, in this case the sociologico-political tenets of COMMUNISM. L. H. G.

JARED, or **JERED,** mentioned in the genealogical, or as some hold the ethnological, tables of the BOOK OF GENESIS (5:15), as the son of Mahalaleel. At the age of 162 he became the father of Enoch, and lived 800 years afterwards "and begat sons and daughters." The origin of his name is admittedly obscure, although some scholars who think Jared a hero of a Mesopotamian culture legend find his name related to the Babylonian Arad-Sin, the "servant of the Moon God."

JARGOON. *See* ZIRCON.

JARNDYCE vs. JARNDYCE, in Dickens' *Bleak House,* an interminable Chancery lawsuit around which the plot of the novel revolves. The case, which becomes a laughing-stock even to the lawyers who have grown rich by it, after being in Chancery for many years, is at last settled; every penny of the once great estate has been eaten up by "costs." Dickens alleged that he had depicted a typical case without exaggeration.

JARRAH, a species of eucalyptus (*E. marginata*) native to southwestern Australia, highly valued for its timber. The very hard, close-grained, mahogany-red wood, so heavy that it sinks in water, is widely used in construction. It makes valuable marine timber, resisting the attacks of the shipworm (*Teredo navalis*) and is useful in tropical countries because of its immunity to the ravages of termites.

JARVIS, JOHN WESLEY (1780-1834), American portrait painter, was born in England in 1780. He came to America at the age of five and after practicing engraving took up portrait painting. His principal works are in the City Hall, New York, and the New York Historical Society. The Metropolitan Museum, New York, has his *Portrait of a Man* and *Alexander Anderson.* Jarvis died at New York, Jan. 12, 1834.

JASMINE, the common name of a numerous genus (*Jasminum*) of shrubs of the olive family, sometimes called also jessamine. There are about 200

species, native to tropical and subtropical regions, many of which are grown as garden ornamentals in warm climates and as pot shrubs in the north. They are small, climbing or erect shrubs, often evergreen, with usually opposite leaves, clustered, highly fragrant, pink, yellow or white flowers and a two-lobed, berry-like fruit. Among the best known cultivated species are the jessamine of poetry (*J. officinale*), a weak shrub, native to Persia, with sweet-scented white flowers, and the Arabian jasmine, a climbing shrub native to India, with many double-flowered varieties. The Spanish jasmine (*J. grandiflorum*), native to India, is an upright shrub with large purplish flowers which yield the oil of jasmine used in perfumery. In China jasmine flowers are used for scenting tea.

JASON, in Greek mythology, son of Aeson, King of Iolcus, was driven from his father's kingdom by his half brother PELIAS, who assumed the rule. Jason was brought up by the centaur, CHEIRON, and in time returned to claim the throne. Pelias had been warned by an oracle to beware of a man wearing one sandal. Therefore, when Jason appeared with but one sandal, Pelias promised to give him the kingdom if he would obtain for him the Golden Fleece from Colchis, where it was guarded day and night by a dragon. Jason, with Athena's help, had a ship built which was named the Argo, and gathering about 50 heroes to aid him, set out on what is known as the Argonautic Expedition, in quest of the Fleece. After many adventures the expedition reached Colchis, and with the help of the king's daughter, MEDEA, Jason accomplished his purpose. Taking Medea with him, Jason sailed back to Iolcus. Here Medea, with the pretense of restoring youth to Pelias, caused his daughters to dismember him and put him in a cauldron. For this Jason and Medea were banished. Finally tiring of Medea, Jason married Glauce, but Medea not only caused Glauce's death, but killed her own children by Jason. One legend says that Jason then killed himself, while another states that he was injured fatally on his ship.

JASONVILLE, a city in Greene Co., southwestern Indiana. It is situated 25 mi. southeast of Terre Haute and is served by railroads and bus lines. Grain is the principal crop of the region. Coal mines lie in the vicinity. Shakamak State Park lies about 1½ mi. northwest. Jasonville was founded in 1858 and incorporated in 1900. Pop. 1920, 4,461; 1930, 3,536.

JASPER, an opaque form of CHALCEDONY, or cryptocrystalline quartz. It is found in a variety of colors, all due to impurities, usually iron oxides. When beautifully colored, jasper is used as a semi-precious stone in jewelry, and for ornaments and ornamental stone. In ancient times it had great repute as a rain-producing charm and cure for snake bite. The banded, siliceous iron ores of the Lake Superior region are in large part red jasper. Common colors for jasper are red, yellow, brown, black and green. Banded jasper is found along the Nile, in Siberia, Saxony and England. *See also* HEMATITE; GEM STONES.

JASPER, a city in northwestern Alabama, county seat of Walker Co., situated 41 mi. northwest of Birmingham, served by three railroads. It is in the midst of rich coal fields and timber tracts. The leading agricultural interests are grain, fruit and poultry. The city has leather, textile and building material factories. Pop. 1920, 3,246; 1930, 5,313.

JASPER PARK, a Canadian national park established Sept. 14, 1907; area 4,200 square miles, the largest park in the world, situated in western Alberta. The region is a vast mountain wilderness, much of it unexplored and containing numbers of unclimbed peaks, tremendous glaciers, ice-fields, canyons and innumerable lakes of wonderful coloring. The upper drainage of the Athabaska River lies within the park forming the famous pass to the Columbia. On the east the mountains rise abruptly from the plains to heights of 6,000 and 7,000 ft., increasing toward the west to the climax of the Rockies, the Columbia ice-field, an area of 110 sq. mi. with an average elevation of between 9,500 and 10,000 ft. or practically 3,000 ft. above the timber line. It is surrounded by more than a dozen peaks of the first magnitude and has been called the "Mother of Rivers," as rivers flowing to three oceans rise here. Thirty named peaks in the park rise above 10,000 ft., two above 12,000. Outstanding among these are Mt. Edith Cavell. Mt. Columbia, Mt. Athabaska, Mt. Alberta, Mt. Brown, Mt. Hooker and the North and South Twin Mountains. Wild life includes large herds of elk and rocky mountain goat, black, cinnamon and grizzly bear, caribou and over 10,000 moose, all protected by game laws. Fishing is excellent. The park is named after Jasper Hawes, who in 1807 established Jasper House, a post of the North West Company in the Athabaska Valley. The valley was a favorite route for fur traders, and the entire region is rich in historic associations. Many early explorers, including David Thompson, passed through on their way to the Pacific. Next came scientific adventurers, gold seekers, big game hunters and, in 1875, the railroad. The park is traversed by the main line of the Canadian Pacific, entering on the west through the Yellowhead Pass and on the east through the Athabaska Valley. The town of Jasper, the administration center of the park, is 236 mi. from Edmonton. Jasper Park Lodge near Jasper is the tourist center and the attractions provided there include camping, riding, hiking, mountain-climbing, fishing, canoeing, bathing, tennis and golf on the famous Jasper course. The few motor roads in the park chiefly follow the main valleys. A road up Mt. Edith Cavell, 11,188 ft. high, leads practically to the foot of the glacier.

JASSY or **IASI,** a city in RUMANIA, the largest and most important in Moldavia. The Bahlui River is on one side and an eminence covered with vineyards, gardens and woods on the other. Spaciously laid out, the wide streets are lined with mostly one story houses, more than 100 synagogues and Greek Oriental churches, among them a four-towered cathedral and the lavishly decorated "Church of the Three Saints."

The city is the seat of a Greek Oriental metropolitan and a Roman Catholic bishop. Among the secular buildings are the university, government buildings, art academy, several palaces, many schools, museums and libraries. The chief manufactures are in metal, woven goods and soap; and there is a good trade exporting agricultural products and wine and importing coal, hides, textiles and sugar. Destroyed in 1510 by the Tartars, Jassy became the residence of the princes of Moldavia in 1565, and was long the center of Rumanian intellectual life. Of the inhabitants 40% are Jewish. Pop. 1930, 102,595.

JASTROW, JOSEPH (1863-), American psychologist, was born at Warsaw, Poland, Jan. 30, 1863. He graduated from the University of Pennsylvania in 1882 and received his Ph.D. from Johns Hopkins in 1886. From 1888-1927 he was professor of psychology at the University of Wisconsin. In the latter year he became associated with the New School for Social Research. Jastrow also conducts a daily newspaper column entitled "Keeping Mentally Fit." Among his works are the following: *The Psychology of Conviction,* 1918; *Fact and Fable in Psychology,* 1900; *The Subconscious,* 1906; *Character and Temperament,* 1915. He was the editor of the Metapsychology department in the National Encyclopedia, 1932.

JASTROW, MORRIS, JR. (1861-1921), American Orientalist, was born in Warsaw, Poland, Aug. 13, 1861, and brought to Philadelphia, Pa., when a child. He was educated at the University of Pennsylvania and in Leipzig and Paris; in 1885 he returned to the University of Pennsylvania where he became professor of Semitic languages and librarian. An acknowledged authority on Orientalism, his important works include *The Civilization of Babylon and Assyria, Hebrew and Babylonian Traditions, The War and the Coming of Peace, The Eastern Question and Its Solution, Hebrew and Babylonian Traditions* and *Zionism and the Future of Palestine.* Jastrow died in Jenkintown, Pa., June 22, 1921.

JAUNDICE, a term applied to a yellowish or yellowish green staining of the skin, mucous membranes and deeper tissues and also of the excretions (except feces) with bile pigments, known also scientifically as icterus. All of the tissues and organs with the exception of the nervous system are stained. The bile usually gains entrance through the lymphatics of the liver and thence by way of the thoracic duct to the blood stream, but may enter the blood stream directly through the hepatic or liver veins. Jaundice is a feature of a wide variety of conditions and is not a disease entity.

There are three main types, classified according to causative factors: (1) obstructive, (2) toxic and infective and (3) hemolytic. Normally about 1,500 c.c. or 1½ quarts of bile are secreted by the liver cells daily (the gall-bladder does not take part in the manufacture of bile), and the bile is carried by way of the ducts to the duodenum for admixture with the intestinal chyme to aid in the process of digestion. (*See* GALL-BLADDER).

Obstructive jaundice results from obstruction of the larger bile ducts and may be due to inflammation of these ducts, to impaction with gall-stones or parasites, to tumors or scar contractures within the ducts, or to congenital obliteration of the ducts, or adhesions, or, finally, to compression of the ducts from without by glands or tumors of adjacent organs.

Toxic or infective jaundice occurs in many diseases of the liver, in acute fevers and infections, and as the result of poisoning with phosphorus, arsenic, toluendiamine, snake venoms, etc. This form is primarily the result of liver cell damage, with inflammation of the bile capillaries and consequent obstruction of the bile capillaries and smaller bile ducts, due to concentration and increased viscosity of the bile.

Hemolytic jaundice is applied to any case in which the jaundice is due to increased destruction of the red blood cells and not to obstruction of the bile ducts. It is usually accompanied by enlargement of the spleen and anemia and is most commonly congenital or familial. Bilirubin or bile pigment is increased in the blood but bile salts are not increased. The jaundice of new-born infants is probably of this type.

The symptoms are due to the presence of bile pigment and bile salts in the blood and the absence of bile in the intestines. The former causes the yellow pigmentation of the integument and the discoloration of the urine, the slowing of the pulse, the distressing itching, and to a lengthening of the coagulation time of the blood which often gives rise to PURPURA or even to severe hemorrhages elsewhere. Not infrequently severe toxemia (cholemia) may occur, in part due to liver cell damage interfering with the normal detoxifying mechanism in the liver. Cholemia causes mental depression, headaches, insomnia and may lead to convulsions, delirium, coma and death.

The most important functions of bile in the digestive process are the stimulation of intestinal muscular action, the saponification of fats and the pigmentation of the fecal contents. In the event of obstruction of the flow of bile, therefore, the stools contain large amounts of undigested fats, are devoid of pigment, thereby becoming white or clay colored, are often fermentative and, because of the failure of proper muscular stimulation, constipation usually occurs. *See also* CHILDREN, DISEASES OF: Diseases of the Newborn.

G. H. C.

JAURÈS, JEAN (1859-1914), French Socialist leader, was born at Castres, Sept. 3, 1859. He was educated at the College de Castres and the Ecole Normal Supérieure, 1878-81, and early showed great talent as an orator. For a time he taught philosophy at the University of Toulouse; but politics attracted him, and in 1885 he was elected deputy from the department of Tarn. From the beginning of his Parliamentary career he was deeply interested in social and labor legislation. In 1889 he was defeated in the election as a result of the return to the *Scrutin d'arrondissement* and returned to teaching. During this time, he wrote several excellent works on philosophy

in which his Socialistic ideas again found expression. In 1893 he was reelected to the deputies, but five years later he was again defeated. During the next four years 1898-1902, Jaurès devoted himself to Socialist propaganda and journalism in the *Petite Republique,* vigorously defending Dreyfus, in whose cause he wrote *Les Preuves.* At this time he was also an earnest champion of the program that the Socialists should cooperate with the other parties in the Government and so gradually bring about socialization. In this sense he stoutly defended Millerand at the Congress of Lyons and again at the International Congress of Socialists at Amsterdam. Indeed as a supporter of the "bloc" he exercised a powerful influence on the policies of the Government at this time.

In 1904 he founded *l'Humanité,* which became his political organ. Gradually he abandoned that branch of the party that sought its ends through reform and became a revolutionary. With the retirement of Combes he went into opposition. His ardent championship of peace, in view of his wide influence, made him an object of fear to the Nationalists. This led to his assassination just before the outbreak of the war on July 31, 1914.

JAVA, the most important island of the Dutch East Indies, bounded on the north by the Sea of Java, on the south by the Indian Ocean, on the east by the Strait of Bali which separates it from the island of Bali, and on the west by the Straits of Sunda which separate it from Sumatra. Borneo lies immediately north of Java, at a distance of 200 mi., while due south of it the Indian Ocean extends continuously to Antarctica. In form Java is long and comparatively narrow; the extreme length is 666 mi. and its breadth varies from 45 to 120 mi. With the adjacent island of Madura, administratively belonging to Java, the whole area is 50,557 sq. mi.

Surface Features. The entire northern coast with few exceptions is an alluvial plain forming some of the most fertile rice and sugar lands in the island. Here are found the chief towns and ports, though natural harbors do not exist. Inland there follows an undulating or hilly tract of tertiary rocks which furnish a soil much less fertile than that of either the alluvium or the volcanic rocks. The oil fields of Java and most of the teak plantations are here. The volcanic belt consists of a complex string of volcanoes separated by high plains filled with volcanic ash of great fertility. Many of the smaller tuff-cones are terraced from base to summit, and it is in this part of Java that the amazing panoramas of curvilinear paddy fields rise one above the other in an apparently endless succession. The higher slopes of the volcanoes are often forested and attract a heavy rainfall, which is stored sufficiently long to assist in the irrigation of paddy fields late in the season. A folded mountain belt lies towards the southern coast. Large areas are rugged and wild, still covered with dense evergreen forest and forming a barrier broken only in two main sections between north and south. The narrow coastal strip in the south consists largely of raised coral reefs covered with laterite or hill-wash. The dominant features of the surface of Java are the numerous volcanoes; twenty or more reach heights exceeding 8,000 ft.; many are over 10,000 ft. and rise to cloud-capped heights in a beautiful symmetrical concave-sided cone. Several of the volcanoes are still in the solfataric stage of activity.

Rivers. The rivers, especially on the north side of the island, are almost innumerable, but because of Java's form they are of comparatively small size and only a few are navigable. Their rapid flow and perennial supply of water are excellent for irrigation. The largest and most useful river is the Solo, which has its course in one of the low ranges of hills on the southern side of the island and after a tortuous course of 310 mi. empties itself into the sea by two mouths opposite Madura. It would be accessible to ocean vessels but for the bar at its mouth. Except for three months of the year the river is navigable for large boats and at all times for small ones. The other important rivers are the Brantas or Surabaya, the Chi Tarum and the Chi Manuk, but they are of little value save for irrigation. The physical conditions prevent the formation of inland plains or lakes.

Agriculture. Agriculture is divided naturally into native and plantation cultivation. The greater part of the soil is claimed as government property, and is let out on hereditary long lease to natives. The principal privately-owned estates, held by Europeans or Chinese, are in western Java. Rice is the main product of native agriculture and the staple food of the people. Twenty-three per cent, or 7,250,000 acres of the island's surface is under wet paddy; a further 3½%, or 1,100,000 acres among the mountains is under dry or hill paddy. Other crops than rice under cultivation are maize, cassava, sweet potatoes, peanuts, soya beans, tobacco, tea and capsicum, or chillies. Quite distinct are the plantation crops, grown mainly for export. Sugar cane easily occupies first place and comprises about 10% of the world's total output. Tea takes second place among the plantation products, with coffee, rubber, tobacco and cacao following. Of special interest is the cultivation of cinchona, for a long time practically a government monopoly. Java now produces nearly the world supply of quinine. The yield from Javanese bark is now double that of the original Peruvian bark. The estates are nearly all in the province of Preanger in the western part of the island, at elevations of 4,500 to 6,000 ft. Java also provides a major share of the world's cocaine, obtained from the leaves of the coca tree.

The Javanese are excellent agriculturists. Extensive valleys and mountain sides are terraced and leveled in steps, and these are irrigated so that every plot can be flooded or dried at pleasure. These terraced lands are continually being extended and produce a succession of crops all the year round, year after year. They do not require manure because the fertilizing matter held in solution and suspension by all streams is retained instead of being carried away to the sea.

Livestock. Livestock raising is relatively unimportant. The 2,000,000 water buffaloes are needed in the rice fields, as are also some of the 3,000,000 cattle, although this number includes Australian and Friesian cows imported as dairy cattle and kept on the mountain pastures to maintain a milk supply for Europeans. There are 1,400,000 goats and 800,000 sheep, as well as 100,000 pigs kept mainly by the Chinese.

Irrigation. Nearly $5,000,000 annually has been spent recently on irrigation works. The strong surf along the southern coast has prevented the formation of deltas, but all the small streams flowing northward carry large quantities of silt and have built up considerable deltas still rapidly increasing in size. The streams tend to raise their beds by silt deposition above the level of the surrounding plains and hence there is danger of disastrous floods. Therefore permanent works for irrigation and flood control now protect about 2,000,000 acres of cultivated land, and works planned or in progress will affect another 2,000,000 acres.

Flora. Almost one-sixth of the island is still covered with forest despite the denseness of the population. The vegetation varies with the soil, whether composed of the debris of volcanic matter, calcareous rocks or sandstone; but it varies far more according to the elevation of the land. On the low coastlands there are superb palms, bananas and aroids. At an altitude of 1,000 ft. ferns are in preponderate numbers to other plants, and here too are magnificent groves of slender bamboos. The greater the altitude the more temperate is the vegetation. Palms and leguminous plants become rare and bamboos less abundant. In place of these are forests of *Ficus,* with their tall trunks, spreading branches and thick foliage; beautiful tree ferns and orchideous plants. Higher still the figs are mingled with gigantic Liquidambars with white trunks. Above these is the region of oaks and laurels. Forests of teak (*Tectonia grandis*) are to be found throughout the island, but they exist chiefly between Samarang and Surabaya in the lower ground. Injudicious felling had at one time reduced them considerably, but under careful management matters are now more satisfactory. The teak plantations cover 1,800,000 acres. Afforestation with the blue gum (*Eucalyptus sp.*) and other trees has been carried on by the government. In fruits the island is remarkably rich, and the markets of Batavia exhibit innumerable varieties of which most are strange to European and American eyes. It is here that the durian, mangosteen, rambutan and other typically Malayan fruits appear in perfection.

Fauna. Among the large animals are the rhinoceros, tiger, leopard, wild dog, wild ox and two species of wild swine. Deers, squirrels and monkeys are abundant. A singular animal, somewhat intermediate in appearance between a polecat and a badger, is the mydaus, remarkable for its habitation on the higher mountains only. It emits an offensive stench like that of the American skunk. There are pea fowl, jungle fowl, partridge and quail. About 240 species of land birds are known to inhabit the island and at least 40 are peculiar to it. In reptiles, freshwater fishes and insects Java is very rich. The insects are especially fine in appearance, and among the beetles and butterflies there are some of magnificent dimensions and colors.

Climate. Climatically Java is just outside the equatorial belt, being situated between 6° and 9° S. lat. Nevertheless, Java is sufficiently near the Equator to have the small annual range of temperature characteristic of truly equatorial stations. In Batavia the yearly average is 78.6° F.; the annual range between January, which is curiously enough the coldest month, and May, the hottest, is less than two degrees. In Java, temperature depends on altitude, not on season. The decrease in the average yearly temperature is about 1° F. for every 310 ft. of ascent. The snow line would lie far above the tops of the highest mountains, but frosts are common in the dry season, especially on high enclosed plateaus from 4,500 ft. upwards. The high humidity throughout the year is another characteristic of the climate; even in the driest month the mean relative humidity is 78% at Batavia. Broadly speaking, there are two seasons in Java, the dry season and the wet season, but the terms are comparative rather than absolute. In the dry season the island is under the influence of the east or southeast monsoon, especially marked in July, August and September, which naturally brings heavy rainfall to a great part of the southern coastal strip, though it is the dry period for most of the island. In the wet season the west or northwest monsoon blows, especially in December, January and February, and is the main rain-bearing wind except along the southern coast. Over the fertile lowlands of the north the annual rainfall is in general between 40 and 80 in., and it has been very desirable to protect cultivation, especially that of rice, by irrigation works which insure a regular and constant supply of water, and by protective works against flooding.

Minerals. Although the output of petroleum of the East Indies amounted to 38,072,000 bbls. in 1929, the oil fields in Java and Madura yielded but a small proportion of the total. Iodine is recovered from springs in the neighborhood of Surabaya.

Inhabitants. With its satellite island Madura, Java is in many ways unique. It is one of the most densely populated agricultural countries in the world, with 717 persons per square mile in 1926. But a very large proportion of the surface is over 3,000 ft. above sea level, and of necessity the density of population drops to 160 to the square mile in certain of the more mountainous districts. This remarkable density has been attained in the last century: in 1800 the total population was estimated at between 3 and 4 millions, in 1850 at 11,000,000, in 1900 28,000,000, and in 1926 36,000,000. The sturdy, brown-skinned Javanese form the bulk of the population and furnish an almost unique example of an industrious equatorial race. Most of them are Mohammedans. In 1926

there were only 461,000 other Orientals, chiefly Chinese. On Dec. 31, 1926, Java was inhabited by 169,200 Europeans, the great majority of whom were of Dutch descent. The Dutch population is mainly urban; 31,000 live in Batavia, 18,000 in Samarang and 10,000 in Bandung—but the Dutchman goes to Java to settle, and he has evolved a bungalow residence essentially European in type. The color bar is less marked in Java than in most places of the East, and there is, or has been, considerable intermarriage. The Eurasians do not form a very distinct community, but mix freely with the pure Europeans. In 1930 Java had a population, with Madura, of 41,719,524.

Language. Of all the languages spoken in Java, Javanese is the most important and most widely employed. Its peculiar alphabet is based on the *Dewanagari* and is found in inscriptions and manuscripts of the 12th century, although in its present form it is not more than 400 years old. Omitting the *Kawi,* or ancient language, there are two distinct forms: the *krama* or court speech and the *ngoko* or vulgar dialect. Something of the same kind is found in Malay where there are the Raja Malay and Bazaar Malay languages. Sudanese is ruder and less cultivated, although it possesses, like Javanese, the two forms of dialect. Madurese, though allied to Javanese, is still sufficiently distinct to take rank as a language.

Industry. Among native industries bamboo hat-plaiting and the famous batik work may be noted. Although imported cottons printed with the old batik patterns have to a great extent destroyed the real batik industry, there is still a touch of racial pride in the desire of many Javanese to possess at least one *sarong* or some garment of genuine batik. The Javanese work is a process of dyeing cotton cloths. Elaborate patterns are traced on the fabric and all parts not to be dyed are covered with wax on both sides. The cloth is then dipped a dozen or more times in the dyeing solution, blue or brown as the case may be. The wax is then cleaned off; the parts already dyed are covered with wax, and other designs are traced on the undyed portions before the whole is dipped in the second dye. Elaborate patterns in dark blue, brown and white are thus produced in great variety and striking individuality. Native copper working is another industry of interest. The Javanese make splendid boats and canoes. Their krisses or daggers are also excellent, the steel blades being finely figured, and the handles and sheaths worked in ivory or the finest woods ornamented with gold or jewels.

Communications and Towns. There is an excellent system of roads with two main highways running east and west connected by a number of cross-roads. The railways (3,000 mi.) center on the three main ports of Batavia, Samarang and Surabaya. The old harbor of Batavia is now used as a fishing port and the new, well-equipped harbor at Tanjong Priok lies 5 or 6 mi. to the east. Samarang has only an open roadstead, but Surabaya is well sheltered by the island of Madura and a harbor basin has recently been constructed. These three ports are respectively the main outlets of western, central and eastern Java. There are several other small ports. Among important inland centers are the fine city of Buitenzorg with its famous botanical gardens; Bandung, in the heart of the fertile high plains of the west; Garut, a delightful hill station; and Djokjakarta and Surakarta, two native towns in central Java with over 100,000 inhabitants. BATAVIA (pop. 290,408) is the capital of the island and of the Dutch East India possessions. It has a considerable entrepôt trade, but in this respect is over-shadowed by Singapore, only 36 hours distant by steamer.

JAVANESE DRAMA. The oldest form of drama in Java is the *Wayang Poorwa,* also called *Wayang Koolit. Wayang* means shadow, and the actors in this Javanese drama are actually the shadows of puppets cut out of buffalo leather which are thrown upon a white screen by the showman.

According to an early legend this shadow play was taught to the people of Java by the Hindu gods Shiva and Vishnu. This is a poetic way of stating that the *Wayang* has a sacred origin. It sprang indeed from primitive spirit worship, and must therefore be older even than Java's knowledge of Hindu gods, which was brought to the island by conquerors from India in the early centuries. The showman, called *dalang,* was originally the priest of a sacred rite, a shaman or spiritistic medium through whom the spirits of the dead were heard to speak. It is a survival of his former sacerdotal function that he must open the play with an offering to the spirits of the dead. The fantastic dolls whose shadows he throws upon the screen were not mere symbols originally, but were the spirits themselves called to earth



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JAVANESE MARIONETTES

by the music of drum and gong. These puppets are flat dolls cut out of buffalo leather, grotesque figures that seem to be all arm, a sort of cross between locust and man. The *dalang* holds each puppet up by a thin handle of horn on which it is fastened, and

moves the angular arms by similar thin sticks affixed to the hands. And while he manipulates his marionettes, he conducts the orchestra behind his back with almost imperceptible signals, and intersperses the dialogue of his shadow play with the recitation of descriptive passages and with melodious lyrical outbursts. The performance begins after sunset and lasts all through the night. The male audience watches the show on the side of the screen where the *dalang* sits, so that they see the puppets in all their gaudy colors; the women and children sit on the other side and see the shadows. *See* MARIONETTES.

The Javanese have another kind of *Wayang* which they call *Wayang Gĕdog*. This differs from the *Wayang Poorwa* in its repertoire only, and in the music of the *gamelan* (orchestra) that accompanies the performance. The *lakons* (plays) of the *Wayang Poorwa* are derived from *Mahabharata* and *Ramayana*, the great *Sanskrit* epics of ancient India; those of the *Wayang Gĕdog* belong to the Panji cycle, the hero of which, Raden Panji, is known by various epithets, part of which is always a word meaning horse; hence the name *Wayang Gĕdog*, gĕdog being an old-Javanese word for horse.

Other kinds of *Wayang* are 1. *Wayang Kĕlitik*, meaning "little wayang." The puppets are of flat painted wood, in imitation of the leather ones. Not their shadows but the puppets themselves are the actors, and originally they performed within a large square opening made in the screen. But nowadays the screen is dispensed with. 2. *Wayang Golek*, played by puppets resembling the western world's marionettes; this *wayang*, however, is not indigenous but was probably imported from China in the early 19th century. 3. *Wayang Topeng*, played by masked actors, the repertoire being similar to that of the *Wayang Gĕdog*. 4. *Wayang Wong*, played by unmasked actors, the repertoire being similar to that of the *Wayang Poorwa*. 5. *Wayang Bèbèr*, a primitive kind of motion picture, which in a Chinese report of 1416 is described as follows: "There is a sort of men who paint on paper men, birds, animals, insects, and so on; the paper is like a scroll and is fixed between two wooden rollers three feet high; at one side these rollers are level with the paper, whilst they protrude at the other side. The man squats down on the ground and places the picture before him, unrolling one part after the other, and turning it towards the spectators, while in the native language and in a loud voice he gives an explanation of every part; the spectators sit around him and listen, laughing or crying according to what he tells them." This Bèbèr show is still in existence. Its repertoire is taken mainly from the *Wayang Poorwa* and the *Wayang Gĕdog*. A. J. B.

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JAVA SEA, part of the Pacific Ocean, bounded on the east by the Strait of Macassar and the Sea of Flories, on the south by the islands of Java and Bali, on the north by Borneo, and on the west by Sumatra. Through the Straits of Sunda this sea connects with the Indian Ocean and through the passage of Caramita with the China Sea.

JAVELIN THROWING, an event of the ancient Olympic Games, revived at the first of the modern series and now on the programs of all championship track and field meets. The modern javelin, a wooden shaft with a sharp steel head, may not be over 8½ feet long nor weigh less than 1.6 pounds. The grip at the center of gravity is wound with cord. The throw is made from behind a line which must not be overstepped, and is measured from the line to the point where the head strikes. The thrower may take a preliminary run of any length, most experts running about 60 feet. At from 12 to 16 feet from the line, the thrower draws back his arm, bending back and turning his body to the right, and at 6 feet he throws, turning his body to the left as does a shot putter. A good throw must have no break in the series of movements, and the shaft must not vibrate.

Javelin throwing first became popular in Finland and Sweden, which still produce the best javelin throwers. The world's record was set in 1930 by Matti Jarvinen, of Finland, with 239 ft. 3¼ in.

JAY, JOHN (1745-1829), American revolutionary leader, statesman and jurist, first Chief Justice of the United States, was born at New York City, Dec. 12, 1745, the son of a wealthy merchant. He was brought up at Rye, graduated from King's College (now Columbia), in 1764 and was admitted to the bar in 1768. He became a prominent lawyer, served on the commission to settle the boundary disputes of the Provinces of New York and Connecticut, and in 1773 married Sarah Livingston, daughter of William Livingston, thereby allying himself with one of the great Whig families of the Province.

When relations between the colonies and England reached the point of violence in 1774, Jay accepted a post upon the Committee of 51 to sound out sentiment in the other Provinces and soon was sent as delegate to the First Continental Congress, at the same time being placed upon many New York revolutionary committees. But Jay in those years was still unwilling to face a break with England and allied himself with the conservative opinion in support of GALLOWAY, later a Tory. As the inevitability of rupture became more clear, Jay accepted a colonelcy in the New York City Militia and in May 1776 was recalled to New York to become a member of the Provincial Congress. For this reason he was not a signer of the Declaration of Independence, but he used all his influence to have New York authorize its delegates to sign.

Jay then threw himself actively into revolutionary work in New York, serving upon the Council of Safety, drafting the first Constitution of the State, and becoming the first Chief Justice. In 1778, however, he returned to the national field as President of the Continental Congress, succeeding HENRY LAURENS, but his tenure was brief, for in September

1779 the Congress sent him to Spain to obtain recognition and a loan.

Spain was actively at war with England, but Jay was not received, and the sight drafts which the Congress drew upon him without waiting to discover whether he had obtained a loan were an enormous difficulty. He borrowed a little from private sources here and there, but at length Congress gave up hope of Spain and in 1782 ordered him to Paris to join Franklin in quiet pourparlers with England looking toward the conclusion of peace. Jay continued in Paris throughout the negotiations and with Jefferson, Franklin, John Adams and Laurens signed the treaty of peace, Sept. 3, 1783.

Jay returned to New York where he was elected to the Congress of the Confederation in 1784 and was Secretary for Foreign Affairs while the Articles of Confederation remained in force and, for a brief period, first Secretary of State under the Constitution. Both Jay's conservative political viewpoint and his practical experience with the shortcomings of the Confederation made him an earnest supporter of the Constitution and he returned to New York to join Hamilton in the fight for its adoption. He wrote five papers for the FEDERALS and as a delegate to the State Convention at Poughkeepsie assisted Hamilton in winning over enough delegates to obtain ratification, even though by only the narrow margin of 30 to 27.

Washington appointed him first Chief Justice of the United States, but Jay retained this post for only six years and his influence upon the legal growth of the United States was therefore slight. In 1794 he negotiated the Jay Treaty with Great Britain concerning commercial relations, chiefly in North America, between the two countries, and in 1795 he was elected the second governor of New York and continued in this office until 1801. He had previously refused a reappointment as Chief Justice and retired to his country home at Bedford, Westchester County, where he lived for many years, dying there May 17, 1829.

Jay as an ardent Federalist, a man of conservative, even patrician tendencies, was one of the most influential figures in the formative period of the United States and a politician of the most scrupulous integrity. To him and to Hamilton fell the chief task of securing the adhesion of New York to the Constitution against the bitter opposition of New York's third great revolutionary leader, Gov. GEORGE CLINTON. But the election of Jefferson and of Clinton as governor of New York in 1801 destroyed the Federalist Party with which Jay had long been associated, and while Jay's work survived there was no longer scope for his active participation in public affairs.

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JAY, the name applied to numerous birds forming an important division (*Garrulinæ*) of the crow family (*Corvidæ*). They are noisy, exceedingly active birds of brightly colored, often blue and variegated plumage, living chiefly in trees. Though widespread in north temperate regions, where they are usually year-round residents, the jays attain their greatest size and brilliancy of coloration in the warmer parts of America. From the crows jays differ in their much smaller size, the length being usually 12 to 14 in., in their more uniformly arboreal habits, and when on the ground they do not walk but hop. Moreover, the jays have the tails always longer than the wings. Jays are omnivorous feeders, devouring fruits, seeds, insects, eggs and nestling birds. They construct well built nests of twigs and rootlets in trees, laying 4 or 5 eggs, greenish brown in color with darker markings.

The most familiar Old World species is the common European jay (*Garrulus glandarius*), a beautiful bird, 13 in. long, with a crested head and cinnamon-colored plumage variegated with blue, red, black and white. Some 17 species and well-marked varieties are found in the United States and Canada, chiefly in the southwest. Among the best known are the BLUE JAY (*Cyanocitta cristata*), one of the handsomest birds of eastern North America; the Canada jay or Whisky Jack (*Perisoreus canadensis*), one of the best known birds of Canada; Steller's jay (*Cyanocitta stelleri*), occurring from the Rocky Mountains westward, and the green or Rio Grande jay (*Xanthoura luxuosa*), with green, yellow and gray plumage, found along the Mexican border. *See also* PINON JAY. A. B. J.

JAY TREATY, 1795, a treaty between the United States and Great Britain, attempting to adjust the differences caused by the failure of either party to observe certain obligations of the TREATY OF PARIS, 1783, and by English restrictions on American commerce. To allay belligerent sentiment in Congress, President Washington on Apr. 16, 1794, nominated Chief Justice JOHN JAY special ambassador to England. Jay arrived in London June 15, and with Lord Grenville as the British negotiator reached an agreement, signed Nov. 15, 1794, providing for the evacuation by the British of the forts on the northwestern frontier, but definitely deciding no other points involved in the Treaty of 1783. The settlement of the northwestern and northeastern boundaries of the United States was referred to a joint commission. English claims for debts, and American claims for damages on the high seas, were also referred to commissions. The bulk of the treaty was devoted to commercial concessions, by which American trade, with certain qualifications, was permitted with Great Britain and the East and West Indies. A provision which prohibited American vessels from exporting cotton, or any other of the principal staples of the British West Indies from the United States to Europe, was stricken out by the Senate. The treaty was bitterly denounced on its publication in America as a capitulation to British interests.

JAZZ, a type of popular music which took form in the United States about 1914, reached the height of its vogue about a decade later, meanwhile spreading to European capitals, and thereafter suffered a steady loss of favor among musicians who had hastily

interpreted it as a significant contribution to native music, although its value as entertainment proved enduring. Its origin is traceable to ragtime, a species of popular syncopated music developed by the American Negro toward the close of the 19th century; its name is attributed to one Jasbo Brown, an itinerant singer; and its vast popularity may be ascribed to primitive metrical monotony, on the one hand, and to garish serio-comic tonal colors, on the other. Varied dance-steps, the *Texas Tommy, Bunny Hug,* and *Collegiate Glide,* were successively associated with jazz, but the fox-trot speedily ousted these, and in 1931 was virtually the only dance generally performed to this type of music.

According to Paul Whiteman, whose jazz orchestra initiated Europe into the more sophisticated intricacies of this phenomenon, jazz and ragtime have little in common. Describing jazz, he asserts: "You can stick on counter-melodies like the barber-shop quartets; you can yell 'hot dog!' in the midst of some perfectly decorous dance, and make a monkey of yourself generally. You can jazz *Old Hundred* if you like, exactly as you can rag it. But the two are different. Anybody can jazz. It takes a musician to rag a tune." One of the foremost jazz-band directors thus explicitly maintains that jazz is characterized chiefly by unexpected explosions of bizarre behavior, whereas ragtime, its parent, requires genuine skill in the field of syncopation. However, although it cannot be denied that these definitions are largely valid, the latest tendencies of jazz have been to absorb much of the syncopation of ragtime, even while emphasizing its own rhythmic feature, which is monotony. Musically sterile though jazz has proved to be, and was doomed to be, it has contributed to the humorous and sardonic department of percussive music; and as a social phenomenon, if as nothing else, it solicits a brief share of attention.

JEAN CRAPAUD, or Johnny Crapaud, the nickname of the French people. It dates back to the early kings of France, whose heraldic device was three toads (*crapauds*), erect, *saltant;* also to the custom of referring to the inhabitants of ancient Paris (then known as *Lutetia,* or Mudland) as Frogs, because of the muddy streets of the city.

JEAN DE MEUN (c. 1250-c. 1305), one of the leading French poets of the 13th century, was born at Meun-sur-Loire, about 1250. He is famous chiefly for having completed Guillaume de Lorris's *Roman de la Rose.* (*See* GUILLAUME DE LORRIS.) His translations into French include *De re militari* of Vegetius and the correspondence of Abélard and Héloïse. Jean de Meun's *Testament,* written between 1291-96, is full of harsh criticism of the mendicant orders and the women of his time. The poet died about 1305.

JEANNETTE, a borough in Westmoreland Co., southwestern Pennsylvania, situated 23 mi. east of Pittsburgh; it is served by the Pennsylvania Railroad. Jeannette is included in the great Pittsburgh Industrial Center. There is an abundant supply of coal and natural gas close at hand. The city has an important glass industry, making window glass, marine equipment, household ware, lenses, toys, bottle and various other glass products. Glass was the first manufacture but since the beginning of this century steam turbines, power plant equipment, rubber articles and various other commodities have been produced. In 1929 the city's industrial output was valued approximately at $16,000,000; the retail trade reached a total of $5,556,776. Jeannette was settled in 1888 and made a borough in 1889. Pop. 1920, 10,627; 1930, 15,126.

JEAN PAUL. *See* RICHTER, JOHANN PAUL FRIEDRICH.

JEANS, SIR JAMES HOPWOOD (1877-), English mathematician and astronomer, was born at London, Sept. 11, 1877. He was educated at Cambridge where he afterwards became lecturer, and for a while was professor of applied mathematics at Princeton. He is chiefly known through his brilliant applications of mathematical analysis to various problems in physics and astronomy, such as the equiparation of energy in the kinetic theory of gases, and the radiation of energy by a "black body," the stability of rotating masses of gas, with its resultant effects upon the origin of double stars. He proved mathematically that the nebular hypothesis of P. S. LAPLACE is untenable, and studied extensively the problem of stellar evolution, the source of stellar energy, the annihilation of matter, and its conversion into energy, and in general, the wider aspects of cosmogony. His published works include *The Dynamical Theory of Gases,* 1904; *The Mathematical Theory of Electricity and Magnetism,* 1908; *Problems of Cosmogony,* 1919; *Astronomy and Cosmogony,* 1928; *The Universe Around Us,* 1929; and *The Mysterious Universe,* 1930. He was knighted in 1928.

JEAN VALJEAN, the hero of Victor Hugo's LES MISERABLES.

JEBAVY, VACLOV. *See* BREZINA, OTTOKAR.

JEBB, SIR RICHARD CLAVERHOUSE (1841-1905), British classical scholar, was born in Dundee, Scotland, Aug. 27, 1841. He was educated at Charterhouse and at Cambridge University. In 1863 he became a fellow and tutor of his college, and from 1869-75 he was public orator of Cambridge University. From 1875-89 he was Professor of Greek at Glasgow University, and from 1889 until his death he held the same post at Cambridge. In 1891 he was elected member of Parliament for Cambridge University. Jebb was unexcelled as a translator of the classics, his command of Latin and Greek being such as to enable him to translate from English into these languages with the same perfection as he translated them into his own tongue. His most important works are the *Characters* of Theophrastus, *Attic Orators from Antiphon to Isaeus* and, above all, his *Sophocles.* He died at Cambridge, Dec. 9, 1905.

JEDBURGH ABBEY, the ruins of an Augustinian abbey founded in 1118 by David I, in Jedburgh, the county town of Roxburghshire, Scotland, on the River Jed, 56 mi. southeast of Edinburgh. The most im-

portant remnant of the abbey is the church, a splendid example of the Norman and Transition styles. Also noteworthy is the massive 15th century tower which rises at the intersection of the nave and transepts. The abbey, which was ruined in 1545, became national property in 1913.

JEFFERSON, CHARLES EDWARD (1860-), American clergyman, was born at Cambridge, O., Aug. 29, 1860, and studied at Ohio Wesleyan and Boston universities. In 1887 he entered the Congregational ministry as pastor at Chelsea, Mass., where he remained until 1898 when he was called to the Broadway Tabernacle, New York City. In addition he was chosen in 1914 as chairman of the executive committee of the Church Peace Union endowed by Andrew Carnegie. On Aug. 27, 1930 Dr. Jefferson retired from active pastoral duties. His books include *Things Fundamental, Faith and Life, Christianity and International Peace.*

JEFFERSON, JOSEPH (1829-1905), American actor, was born at Philadelphia, Pa., Feb. 20, 1829. He appeared on the stage at four, and spent his youth amidst the privations of theatrical "barnstorming" through the South and West. During the Mexican War he sold coffee and cakes by day and played to the soldiers by night. After appearing with many well-known actors, he visited England and France in 1856, and joined Laura Keene's company in 1857. After Dion Boucicault had rewritten Jefferson's unsuccessful version of *Rip Van Winkle,* it was produced in London, 1865, with great success, and afterwards in New York City. Jefferson played this rôle for 15 years. Other fine performances were those of Dr. Pangloss in *The Heir at Law,* Caleb Plummer in *The Cricket on the Hearth,* and Bob Acres in *The Rivals.* Jefferson published his *Autobiography* in 1890. He died at Palm Beach, Fla., Apr. 23, 1905.

JEFFERSON, THOMAS (1743-1826), third President of the United States, was born on Apr. 13, 1743 at Shadwell, Albemarle County, Virginia. His father, Peter Jefferson, was a pioneer of Welsh descent who had cleared a farm in the Virginia wilderness; his mother was Jane Rudolph. When Thomas was five his father sent him to an English school, and at nine he was transferred to a Latin master; both of his teachers were Scotch clergymen. In 1757 Peter Jefferson's death interrupted his son's education temporarily; but in 1760 the boy was able to go to William and Mary College. Here William Small and George Wythe influenced him mightily and encouraged his naturally industrious and studious tendencies. He wasted little time, for student dissipations had no attraction for him, and he applied himself to a thorough study of the law under Wythe. He established a fairly lucrative practice and began to build himself that home on the hilltop, on his Albemarle County estate near Charlottesville, which was to become famous as Monticello. In 1772 he married Mrs. Martha Wayles Skelton. She was an invalid most of the 10 years of their married life and was survived by but three of her six children. Meanwhile her husband grew to dislike the law and planned to devote himself to farming. This decision was defeated by the progress of events.

Jefferson was by no means indifferent to politics and since 1768 had been a member of the Virginia Colonial legislature. He was much interested in the possibility of organizing a Governmental system based on the rights of men; and when the pre-revolutionary antagonism against Great Britain came perilously near a point of crisis he was one of the leaders in forming a committee of correspondence, and a non-importation association, in 1774. After the royal governor dissolved the legislature in this latter year, he was active in the Virginia Convention. The climax of his revolutionary experience occurred during his service as one of Virginia's representatives in the Continental Congress. Here in 1776 he was chosen chairman of a committee to draw up a declaration of independence, and the result of his work was adopted and promulgated July 4, 1776 (*see* INDEPENDENCE, DECLARATION OF); therein the philosophy of JOHN LOCKE had been skillfully adapted to American problems and to the justification of America's desire for independence.

Diplomatic Career. In the latter part of 1776 Jefferson returned to the Virginia legislature and was active in revising her laws to meet conditions of freedom. He actively promoted measures to abolish entails and primogeniture, to disestablish the Church and to guarantee freedom of worship, and to make education more universal. From 1779-81 he was governor of Virginia and in the latter year he determined again to retire to Monticello. However, in the next year his wife died and left him to struggle with sorrow and depression. As a relief from this suffering, he returned to Congress where in 1784 he drafted the first Northwest ordinance, which provided for the prohibition of slavery and the admission of new states, both of which provisions were stricken out by Congress. It was a relief when Congress chose him to go abroad to sit on the American diplomatic commission working in Paris to negotiate treaties with the various European courts. When Franklin retired in 1785 Jefferson succeeded him as minister at Versailles.

His four years at this important post gave him some opportunity to further the commercial interests of the United States as far as France was concerned; but more important was the effect of this sojourn upon his own outlook and ideas. These were the years when the French Revolution was fast approaching, the years when the advanced scientific ideas of the Encyclopaedists were in full flower, and Jefferson's contact with them was intimate. His delight in diverse intellectual interests was heightened, and his belief in democracy and the worth of the individual crystallized into a religion. While he was in France the United States adopted the Constitution; and when in Sept. 1789 Washington was authorized to seek a head for the new department of foreign affairs, or state as it was shortly to be called, he chose Jefferson, still in France, to fill the place. The latter accepted and in Mar. 1790 arrived at his post.

Jefferson's career in this new field of enterprise was limited in its success by the weak international position of the new republic and by the unfortunate state of European diplomacy, so dumfounded by the French Revolution. He was unable to bring Great Britain or Spain to agree on just or definite boundaries along lines previously laid down in the Treaty of 1783; neither was he able to gain free access to the Mississippi nor commercial treaties from the same Powers. The war which broke out between France and her European neighbors called for a decision on the part of the Washington Administration as to whether they would heed France's call for aid. Jefferson realized it was impossible and joined his colleagues in pursuing a neutral course. When Great Britain began to disregard our commercial rights as neutrals he wished to take retaliatory measures, but could not command support. Washington, in fact, placed more confidence in the advice of ALEXANDER HAMILTON, who was more friendly to the British. As Jefferson and Hamilton seldom agreed, Jefferson found his position embarrassing and resigned Dec. 31, 1793.

Organization of Democratic Republican Party. Jefferson, out of office, was now free to speak openly against certain tendencies, which he had found too pervasive in the new Government as organized by Washington and Hamilton. This Government was too centralized, too aristocratic in its spirit. Strange as it may seem, Jefferson honestly feared that Washington might be persuaded to become a monarch. He noted how Hamilton's financial plans seemed to favor the rich at the expense of the poor, and besides regretted the extent of power they seemed to bestow upon the new Government. Furthermore, he resented favoritism toward Great Britain, which Hamilton especially seemed to cherish and inject into the Governmental policy at the expense of France. Against these characteristics of the Federalist régime Jefferson had been in active protest even while secretary. He had aided in organizing an opposition, or Democratic Republican, Party (*see* DEMOCRATIC PARTY) and while secretary of state had given PHILIP FRENEAU a post in his department to serve as a partial subsidy in running an opposition newspaper. No candidate had been put forward by their party in 1792 against Washington; but 1796 was to tell a different story. After leaving office, Jefferson set himself to increase the strength of the new party by correspondence and by promoting the organization of Democratic Societies, an idea suggested presumably by the Jacobin Club of Paris. These organizations flourished, and Jefferson became an acknowledged candidate to succeed Washington. JOHN ADAMS, however, was elected by the Federalists, receiving but three votes (71 to 68) more than Jefferson. Under the system then in effect, the latter by his defeat became Vice-President, serving from 1797-1801.

During the years of his Vice-Presidency, he varied the rather boring duties of presiding over the Senate by continuing his organizing activities. The events of the Adams Administration played into his hands, and he made much capital out of them. When the excitement over the possibility of a war with France was at its height, the Federalists passed the Alien and Sedition Acts, which made criticism of the President a crime and gave the executive almost despotic power. Jefferson quickly mobilized opposition to this infringement of the rights of the individual and called forth the states to protest. Under the influence of Jefferson and his party associates, the Virginia and Kentucky legislatures issued resolutions laying down the doctrine of the rights of the states and the duty of the states to protest against encroachment of the Federal Government upon these rights. These resolutions served as an effective party platform for the Democratic Republicans to use in the campaign of 1800. Jefferson again opposed Adams, Charles C. Pinckney and AARON BURR, a Democratic Republican, being the other candidates. The Jeffersonians elected 73 electors as opposed to 65 Federalists, but as all the 73 voted for both Jefferson and Burr, there was a tie and it was the duty of the House of Representatives to choose between them. There was some attempt to unite the Federalists upon Burr and thus elect him; but the arrangement failed and the Federalist Congressmen permitted the choice of Jefferson, who was duly inaugurated Mar. 4, 1801.

His Administration. This revolution of 1800, won as it was by such a narrow margin, demonstrated the stability of our political institutions, for the Federalists after 12 years in power, peaceably turned over the reins to their successful rivals; the party representative of the states and the common people had triumphed over the party of the rich and the well-born. Jefferson set about to conciliate all classes, to govern as little as possible and to reduce armament and taxation. He made a good start upon this program; but the insecure position of the United States in international affairs soon made his problem perplexing. The exactions of the Tripolitan pirates made a war necessary, which though successful, required an expensive naval program. More troublesome was the question of the control of the mouth of the Mississippi. The Spanish were not to be depended on to keep it open freely to our ships, and many protests came from the southwest. Jefferson at length determined to attempt the purchase of the land at the mouth of this river from Napoleon, who had recently acquired it from Spain. Napoleon at first was unwilling, because he wished to build an American empire out of Santo Domingo and Louisiana. His failure to conquer the former area made the latter useless to him, and his renewed European ambitions made him fear the loss of it to the British. Suddenly, therefore, he surprised the American negotiators in Paris by offering to sell the whole of Louisiana from the Gulf of Mexico to Canada. Although they had no authority to buy so much, the envoys made the bargain and, after a struggle with his scruples, for he was a strict constructionist and the Constitution nowhere provided for the purchase of territory, Jefferson accepted their arrangements, 1803.

Another major diplomatic problem sorely tried Jefferson's patience and ingenuity and proved an insoluble problem. Great Britain in her contest with France was determined that our merchant vessels should not enjoy French carrying trade and literally feed the French armies. Also she was convinced that many sailors sorely needed in her navy had deserted to ship on American merchantmen. To prevent these two practices, her navy stopped and captured American vessels, impressed American seamen and even carried this policy to the extreme of firing upon an American war vessel and seizing several seamen on her quarter deck. We could do nothing but protest, and France made matters worse by forbidding American vessels to trade with Great Britain and seizing all ships which she claimed violated this prohibition. Jefferson in this dilemma evolved a plan of economic coercion, laying an embargo upon American commerce. By forbidding any trade with Europe he hoped to starve France and Great Britain and thus force them to repeal their orders and decrees. It was all to no avail, and one of the last acts of Jefferson's Administration was signing the repeal of his cherished policy. Jefferson had experienced a troubled Presidency in which opposition, not only from the Federalists but also from many in his own party, such as JOHN RANDOLPH, had often disarranged his plans. Nevertheless, he had the satisfaction of keeping his party in control and of turning over his office to his chosen successor, JAMES MADISON.

Until his death, July 4, 1826, Jefferson dwelt quietly at Monticello. His great achievement during his retirement was the establishment of the University of Virginia. His last years were kept busy by a large correspondence and troubled by debts and poverty.

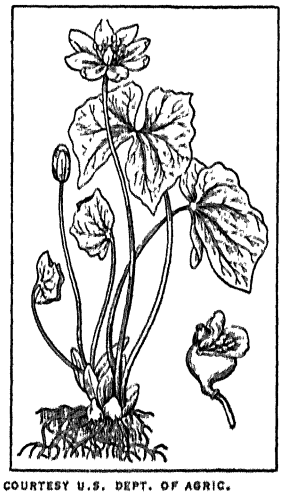
Jefferson himself was a man of wide interests, many of which were surprising. Not only was he a lawyer and statesman in the true sense of the word, but also he was a farmer, architect, musician, philosopher, educator and inventor of many contrivances. No area of human knowledge and interest seemed to be without the range of his curiosity and investigation. He was of medium height, sandy-haired, and enjoyed exceptionally good health; he was a poor speaker and physically rather timid; but his mental audacity knew no bounds and his ideas were most advanced for his or any other day. His great service to his country in the days of its founding was his ability to vision and to formulate principles which were admirably adapted to the conditions of the day, and of sufficient validity to commend themselves to hosts in the succeeding generations. R. F. N.

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JEFFERSON, TERRITORY OF, the provisional Government preceding the organization of the Territory of Colorado. In Apr. 1859 delegates from six mining towns in the Pike's Peak region issued a call for a constitutional convention to establish "a new and independent State." The convention, meeting in August, agreed instead to create a Territorial Government and petition Congress for immediate recognition. In November the Territory of Jefferson was established, upon a constitution ratified by popular vote, with a governor and executive staff chosen in general election. Its legislature in 1859-60 passed comprehensive laws for regulation of mining rights, water rights and land titles, and established codes of civil and criminal law. Discarding the name chosen by the inhabitants and reducing the boundaries materially, Congress created the Territory of Colorado, Feb. 28, 1861.

JEFFERSON CITY, the capital of Missouri, and county seat of Cole Co., situated near the center of the state, on the Missouri River, 125 mi. west of St. Louis. The surrounding country is fine farming land producing fruit, corn and dairy products; live stock is also raised in this region. Three railroads, bus and truck lines serve the city and there is also an airport. The manufactures include shoes, clothing, flour and printed products. In 1929 the factory output reached a total of about $15,000,000. The retail trade in 1929 amounted to $10,588,845. The supreme court building contains one of the finest law libraries in the United States. Jefferson City is the seat of Lincoln University for Negroes, the state penitentiary and the women's prison farm. The state capitol of Missouri is noted for the art work contained in it. Jefferson City was laid out in 1822, and the first capitol was erected in 1826. Pop. 1920, 14,490; 1930, 21,596.

JEFFERSONIA, a genus of attractive perennial herbs of the barberry family named in honor of Thomas Jefferson. There are only two species: the one first discovered is a native of eastern North America, the other is found in Manchuria. The twinleaf (*J. diphylla*) is found in woods from New York to Iowa and southward to Virginia and Tennessee. It grows about a foot high bearing smooth, heart-shaped leaves parted lengthwise into two very similar divisions, whence the name. The attractive white flowers are borne singly on long naked stalks.



COURTESY U.S. DEPT. OF AGRIC.

TWINLEAF
Jeffersonia diphylla

JEFFERSONIAN DEMOCRACY, the political theory associated with THOMAS JEFFERSON. Its tenets, as specified in his first inaugural address, Mar. 4, 1801, are equal and exact justice; zealous care of the right of election by the people; the rule of the majority; preservation of the guarantees of civil liberty (*see* BILL OF RIGHTS); subordination of the military to the civil authority; and economy in administration. Republican government, in Jefferson's theory, depended upon "two hooks:" a demo-

cratic scheme of local government, and an educational system for the people. The political people, in Jefferson's views, were the holders of real estate; he regarded an agrarian democracy, as opposed to government favoring financial and urban classes, as the one healthy type of government. The phrase, as currently used, refers to the principles which the Democratic party is supposed traditionally to exemplify.

JEFFERSONVILLE, a city of southern Indiana and county seat of Clark Co. Situated on the Ohio River, opposite Louisville, Ky., with which it communicates by ferry and by railroad bridges, it is served by three railroads. A municipal bridge built in 1929 at a cost of $5,000,000 connects the city with Louisville. One of the oldest shipyards in the country is in Jeffersonville. The building of railroad cars is the outstanding industry. In 1929 the manufactures reached approximately $5,000,000; the retail trade amounted to $4,498,676. Neighboring points of interest include Clark County State Forest, a monument commemorating the Pigeon Roost massacre, Indian fortifications, and the George Rogers Clark home and monument. The town of Jeffersonville was plotted in 1802 and incorporated 1815; it became a city in 1830. Pop. 1920, 10,098; 1930, 11,946.

JEFFREY, FRANCIS, LORD (1773-1850), Scottish judge and critic, was born at Edinburgh, Oct. 23, 1773. He was educated at the universities of Glasgow and Oxford, and studied law. In 1830 he became Lord Advocate, was a member of Parliament for Edinburgh, and for 16 years was judge of the Court of Session in Scotland. In 1802 he helped found the *Edinburgh Review;* and after the first few numbers, edited it until 1829, contributing to it some 200 articles. Jeffrey flayed the school of poetry represented by Wordsworth, Keats and Shelley, yet his brilliance made him the leading critic of his day. He died near Edinburgh, Jan. 26, 1850.

JEFFREYS, GEORGE JEFFREYS, LORD (1648-89), Lord Chancellor of England, was born at Acton, Denbighshire, Wales. At an early age he became a member of the bar, and soon was noted for his skill in cross examining witnesses, and for his eloquence. He was made a peer on the accession of James II, and was active in the trials following the rebellion of the Duke of Monmouth, ruthlessly persecuting men, women and children. Later he was made Lord Chancellor. On the King's fall, Jeffreys attempted to escape from England; but was arrested and put in the Tower, where he died in 1689.

JEHOL or **CHENG-TE,** a city of Mongolia in the administrative area of the same name, situated in a fertile valley on the Lwan-Ho, 115 mi. north-northeast of Peking. It contains the summer residence formerly used by the Manchu emperors. There are manufactures of inlaid-wares.

JEHOVAH or **YAHWEH,** in the Old Testament the ancient tribal name of the God of the Hebrews. This name came to be regarded as too sacred for utterance and the Jews have always avoided its pronunciation except for specified ritual purposes on a few sacred occasions. They substitute for it the terms *Adonai* or *Elohim.* The name is often contracted to *Yah* and appears as such in the suffixes of terms like *Halleluiah* or proper names like Isaiah or Jeremiah. The origin of the name is uncertain and in considerable dispute. An older etymology connected it with a Hebrew root implying self-existence; a more recent derivation is from an Aramaic root for cause-to-fall (rain or lightning). Others attempt to identify Jehovah with Babylonian deities or other Semitic gods.

JEHU, in Biblical history the son of Jehoshaphat, and a general and king of Israel. Under the inspiration of the prophet Elisha, Jehu succeeded in reuniting temporarily the two Hebrew kingdoms, and in supplanting the worship of the heathen God Baal in Samaria. Jehu ruled over Israel in the 9th century B.C. An account of his exploits is found in the Book of Kings.

JEKYLL, DR., AND MR. HYDE, THE STRANGE CASE OF, a weird, symbolic tale of man's dual personality, by R. L. STEVENSON; published 1886. The handsome, kindly Dr. Jekyll one day discovers a drug having the supernatural power of changing personality. He tastes the potent liquid and is immediately transformed into the misshapen monster, Mr. Hyde, whose only delight is in evil deeds. The transformation is worked many times, until at last the drug loses its magic, and the monstrous Mr. Hyde, unable ever again to be Dr. Jekyll, kills himself in despair.

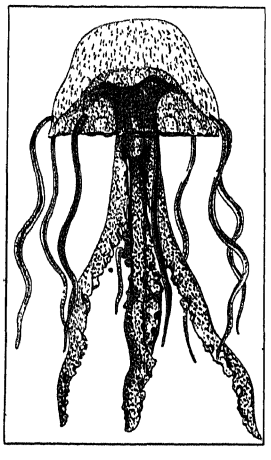
JELGAVA (MITAU), capital of the Latvian district of Semgallen on the River Aa, in its nucleus laid out in East German colonial style, with many frame houses surrounding it. It has a castle, now seat of the government officials, several advanced schools, learned societies, a museum, a library and charitable institutions. The industrial activities include flax spinning, the manufacture of leather and oilcloth and trade in grain and lumber. The city attained some importance in the 16th century and became the residence of the dukes of Courland, whose castle was built on the site of the one erected in 1266 by the Teutonic Order. Pop., 1930, 33,048.

JELLICOE, JOHN RUSHWORTH JELLICOE, First Earl (1859-), British Admiral, was born at Dover, Dec. 5, 1859 and entered the navy as a youth. In 1900 he was placed in command of the East Asiatic Station, in 1911 made Vice-Admiral, and in 1914 appointed Commander-in-chief of the Grand Fleet in the North Sea which he commanded at the BATTLE OF JUTLAND against the German High Sea Fleet May 31-June 1, 1916. The inability of the British at this battle to close with and destroy the German fleet, with the resulting impossibility of conducting naval operations close to the German coast for the remainder of the war, has often been blamed upon Jellicoe's tactics. It seems more probable that the German escape was due to the excellent training of the German ships in maneuvers and in night fighting and to the failure of Admiral Sir David Beatty,

commanding the British battle cruisers, to keep Jellicoe informed of the position of the German ships of the line before the battle began. In 1918 Jellicoe was created Viscount and from 1920-24 was Governor General of New Zealand. He was created an Earl in 1925. He wrote *The Grand Fleet 1914-16* in 1920.

JELLIFFE, SMITH ELY (1866-), neurologist, was born in New York, October 27, 1866. He graduated from the Brooklyn Polytechnic Institute in 1886. He studied medicine at the College of Physicians and Surgeons (Columbia), receiving the degree of M.D. in 1889. He has done considerable study in Europe at various times, and has also the degree of Ph.D. Dr. Jelliffe has served in the capacity of neurologist at various hospitals, and has held professorships in Fordham University, Columbia, and Post-Graduate Hospital and Medical School. He has been editor of numerous medical journals devoted to nervous and mental diseases, being managing editor of the *Journal of Nervous and Mental Diseases* and editor of the *Psychoanalytic Review*. In 1915 he collaborated with William A. White in a discussion of diseases of the nervous system, presenting most advanced views of the nervous and psychic mechanisms as transformations of energy. He is a leading exponent of Freudian psychoanalysis in the United States. *See* PSYCHOANALYSIS. M. F.

JELLYFISH, the popular name for coelenterate medusae, and also for animals of a different phylum (*Ctenophora*) which are like medusae in many ways. As their name implies, their bodies, often beautifully colored, look as though they were made of gelatin. Most of them float near the surface of the open sea. They are animals of low organization, with but one principal internal cavity, the food sac. In practically all of them food enters and waste products pass out through the mouth. Coelenterate jellyfish, or medusae, are shaped like umbrellas. Their mouths are located in the middle of their bodies, and generally face downwards. They usually have long streaming tentacles, armed with stinging cells, hanging from the edge of the umbrella.



PHOSPHORESCENT JELLYFISH

Their life history is extraordinarily interesting. Sometimes an individual begins its adult stage as a sedentary polyp, and later becomes a jellyfish. More frequently a polyp gives rise to a jellyfish by some form of vegetative growth. The jellyfish swims away, and in due course liberates eggs or sperm into the sea. The fertilized egg develops into a polyp. This sequence is known as alternation of generations. First there is a nonsexual polyp generation, and then a sexual medusa generation.

Ctenophore jellyfish have their mouths at one end of their bodies instead of in the middle. They are usually pear-shaped, round, or cylindrical, but some of them resemble worms. There is no alternation of generations among them; the fertilized egg, after a somewhat complicated development, grows into a sexual individual, which, unlike most medusae, is a hermaphrodite.

JEMEZ, a Keresan pueblo and tribe on the Jemez River, 20 mi. northwest of Bernalillo, N.M. The Spaniards found the tribe widely scattered in the valley of the Jemez and its lower tributaries. Later the Jemez consolidated due to wars with other tribes and with the Spaniards. The present pueblo was built about 1700.

JENA, a German city in the province of Thuringia, located in a pleasant valley on the Saale River, about 50 mi. southwest of Leipzig. First mentioned in the 9th century, it became famous on account of its university, founded in 1548 and dedicated in 1558. Jena flourished greatly at the end of the 18th and the beginning of the 19th centuries. In the center of the city is the market place with its rathaus of 1440. Besides St. Michael's Church of the 15th century, are the university buildings and the Black Bear Inn, at which Martin Luther was a guest after fleeing Wartburg. The city walls have been made into promenades ornamented with busts of famous professors and students. The dwellings of great students are also marked; among them are those of GOETHE, Schiller, Fichte, Alexander von Humboldt and Arndt. A stone bridge leads to a town across the river, where in the Inn "zur Tanne," Goethe lived and wrote for some time. The principal industry is that of optical and other scientific instruments. Pop. 1925, 52,649.

JENGHIZ KHAN (1162-1227), a Mongolian conqueror, son of Yesukai, a Mongolian chieftain, was born near the River Onon in Mongolia in 1162. When he was 13, his father's death made him chief. He was immediately forced to fight rebellious subject tribes and was eventually successful. In 1206 he changed his name to Jenghiz Khan or "Khan of Khans" and declared himself destined to be ruler of all the earth. By 1215 he had conquered Peking and all of northern China. In 1218 he and his son set out with a force of 700,000 to invade the domain of Ala-ed-Din Mohammed, emperor of Khorasmia in southern Asia. Within six years the Mongol hordes had overrun and plundered all of southern Asia north of Sutlej, India, and had advanced as far as the Dneiper in Russia. Depletion of his soldiers forced Jenghiz to return to Mongolia. He died while besieging the capital city of Tanjout in northwestern China, August 24, 1227.

JENKINS, a mining city in Letcher Co., southeastern Ky., situated on Elkhorn Creek at the foot of the Cumberland Mountains, 140 mi. southwest of Huntington, W.Va. Busses and two railroads afford transportation. Jenkins was founded in 1912 by the Consolidation Coal Co., which, at great expense and with remarkable skill, converted a wilderness into a

model coal-mining town. During the Civil War the Battle of Picket Rock was fought in the vicinity. The region is the scene of John Fox, Jr.'s *Trail of the Lonesome Pine.* Pop. 1920, 4,707; 1930, 8,465.

JENKS, JEREMIAH WHIPPLE (1856-1929), American educator and economist, was born at St. Clair, Mich., Sept. 2, 1856. He was educated at the universities of Michigan and Halle. From 1891-12 Jenks was professor of political economy at Cornell University; he then took the chair of economics and finance at New York University. In 1912 he served also as financial advisor to the Chinese republic and later acted as Government expert in matters of trusts, labor, currency and taxation. Jenks died in New York, Aug. 24, 1929.

JENNER, EDWARD (1749-1823), English physician, discoverer of anti smallpox vaccination, was born at Berkeley, Gloucestershire, on May 17, 1749. In 1770 he went to London as a pupil of John Hunter, two years later practising as a country physician at Berkeley and devoting his spare time to natural sciences. In 1792 he obtained his M.D. degree from St. Andrews. As early as 1770 Jenner became interested in the study of smallpox and its relation to cow-pox and swine-pox, reviving the interest aroused in the subject earlier in the century. During his investigations a milkmaid told him that the dairy-maids who had contracted cow-pox were immune to smallpox. He then conceived the idea of applying the method on a large scale in prevention of the disease, inoculating his own son to demonstrate its efficacy. On May 14, 1796, he did his first public vaccination, using matter from the arm of a milkmaid who had had cow-pox. Then he inoculated his patient with smallpox virus on July 1, and the immunization proved successful. Jenner published a book and numerous pamphlets on the subject, recording his experiments and improvements in technique. His discoveries were hailed throughout Europe and Asia and he received signal honors for his labors. He died at Berkeley of apoplexy in 1823. A monument was erected to his memory in Trafalgar Square in 1858. *See also* CHILDREN, DISEASES OF: Infectious Diseases.

M. F.

JENSEN, JOHANNES VILHELM (1873-), Danish novelist, was born at Farso, in Jutland, Jan. 20, 1873. His best known work is *The Long Journey,* a series of novels forming a racial epic based on the author's theory that the Gothic race, beginning with the Cimbrians, has led the world from savagery to civilization. The separate volumes in this work are *The Lost Land, The Glacier, Norn Guest, The Trek of the Cimbri, The Ship* and *Christopher Columbus.* In the English translation the first two books have been combined in one volume with the title *Fire and Ice.* Jensen is the author of many other novels and of several volumes of poetry and essays.

JEPHTHAH, in Biblical history one of the judges of Israel and famous in literature for a vow that involved the sacrifice of his dearly beloved daughter. The full story is given in the Book of Judges 11 and 12 which relates that Jephthah, an illegitimate son of Gilead, was exiled from his father's house into the land of Tob in Syria. There he placed himself at the head of a band of nomads and was called upon by the Israelites to defend them against the Ammonites. Then followed his vow to the Lord that if he were successful he would sacrifice "whatsoever cometh forth of the doors of my house when I return in peace." His only daughter was the first to meet him; and thus arose the custom in Israel among the women of an annual lamentation for the daughter of Jephthah.

JEPSON, WILLIS LINN (1867-), American botanist, was born at Vacaville, Calif., Aug. 19, 1867. Graduated from the University of California in 1889, he received the Ph.D. in 1898. In 1896 he was a student at the Gray Herbarium, Harvard, having spent the previous year at Cornell. The year 1905 was spent at Kew, England, in the Royal Botanical Gardens, and the following year at Berlin. In 1891 he became assistant in botany at the University of California, attaining the rank of professor in 1919. In 1899 he went on an expedition to Alaska and the Bering Sea, and in 1926 went on one to Syria and Palestine. Jepson is best known for his studies of California plants. Among his works are: *Flora of Western Middle California, The Trees of California, A Flora of the Economic Plants of California, An Illustrated Manual of the Flowering Plants of California,* and *School Flora for the Pacific Coast.*

JERBOA (*Dipus ægypticus*) a little rodent, 8 in. long, inhabiting the desert tracts of northern Arabia and northern Africa. Because of the length of the hind limbs as compared with the exceedingly short forelimbs, jerboas look like tiny kangaroos. The jerboa progresses by means of leaps so airy that its sand-colored body seems not to touch the ground but rather to fly. It is a shy creature, living gregariously in intricate underground burrows, in which it remains by day and from which it emerges at nightfall to feed on the scanty herbage. A related kind is found in Persia.



JERBOA

JEREMIAH, the last Biblical prophet before the Exile, the son of Hilkiah of priestly family. Jeremiah is recorded to have received visions from Yahweh in the year 626 B.C. as reported in the first chapter of the Book of Jeremiah. He left his native town for Jerusalem, and began to preach a monotheism that castigated mere outward observance of forms and insisted upon inner religious realities.

JEREMIAH, BOOK OF, the second of the major prophetical books of the Old Testament, derives its name from a prophet of the years 629 to 580 B.C. Though accepted as substantially his own work by many, others think that the book has received much editing from other hands. It records certain facts in his own history, but consists largely of denunciation

of sin and warnings of punishment to come. Though frequent mention is made of the forgiveness of God, the temper of the author is elegiac, and most of his discourses are in the minor key, "the harvest is past, the summer is ended and we are not saved yet." It is a book of gloomy realism finding its feeling not only in the prophet's temperament, but in the facts of the times. Jerome says that the Jews, offended by his warnings, finally killed him.

JEREZ DE LA FRONTERA, a city of Spain in the province of Cádiz, charmingly situated in a hilly district covered with vineyards. It has wide streets and fine promenades, a Moorish citadel, ten churches, among them the Gothic San Miguel, a library, theater and bull ring. There is a large trade in sherry wine. The city is extremely old. Near it was the Roman colony *Hasta Regia,* and it is famous for the seven days' battle in 711, in which the Arabs won a victory over the West Goths under King Roderich. Est. pop. 1929, 65,000.

JERICHO, in ancient geography, a city of Palestine, 14 mi. northeast of Jerusalem. The Bible records that the Israelites marched round the walls of the city for seven days and that the defences fell as Joshua blew a trumpet. In the 1st century B.C. HEROD THE GREAT rebuilt the city, which was later destroyed by the Romans. The village of Eriha now stands on the site of Jericho.

JERITZA, MARIA (1896-), Austrian soprano, was born at Brünn, Oct. 6, 1896. She studied at Vienna with Auspitzer, and MARCELLA SEMBRICH. Her début took place in 1910 at Olmutz, Austria, as Elsa in *Lohengrin.* In 1913 she became a member of the Royal Opera, Vienna, and in 1921 made her first appearance at the Metropolitan Opera, New York, as Marietta, in *Die Tote Stadt.* During the period 1921-31 at the Metropolitan her most notable rôles were in *Tosca, Carmen, Lohengrin, Girl of the Golden West* and, in 1931, *Boccaccio.* She has combined a brilliant voice with impressive gifts as a dramatic actress.

JEROME, ST. (c. 340-420), theologian and Christian scholar, Father of the Church, was born at Stridon, near Dalmatia, about 340. After having been baptized at Rome about 360, he studied theology at Trier and settled in 373 at Antioch. He spent the ensuing years, 374-9, as an ascetic in the desert of Chalcis near Antioch and was ordained priest at Antioch. After a short stay at Constantinople (380-1) and a visit to Rome (382-5) he reached Bethlehem in 386, and there lived a life of asceticism and meditation until he died. His greatest work is his translation of the Bible, known as the Vulgate. Other literary works include commentaries on the Bible; controversial works on theology; historical works; letters and translations. Of these his *Letters* have great historical as well as literary value. Also of special interest and importance are the *Sermons* (401-10) and the *Dialogues Against the Pelagians* (1415). St. Jerome died at Bethlehem Sept. 30, 420.

JEROME, JEROME KLAPKA (1859-1927), English humorist and playwright, was born at Walsall, Staffordshire, May 2, 1859. He attended Marylebone Grammar School, and followed various occupations before he turned to writing. In 1889 he published *Idle Thoughts of an Idle Fellow* and *Three Men in a Boat,* two popular humorous books. He wrote many successful plays, of which the best known is *The Passing of the Third Floor Back,* produced in 1907. Jerome did considerable editorial and journalistic work and wrote many novels and an autobiography, *My Life and Times,* 1926. He died in England, June 14, 1927.

JEROME, WILLIAM TRAVERS (1859-), American lawyer, was born at New York City, Apr. 18, 1859. He studied at Amherst College and Columbia Law School, and was admitted to practice in 1884. After serving as assistant district attorney of New York county in 1888-90 and justice of Special Sessions Court in 1895-1902, he became the district attorney of New York county in 1901-09 and gained national prominence for his prosecution of gambling-houses. He appeared in many prominent trials, and was prosecutor of the charges against Harry K. Thaw.

JERROLD, DOUGLAS WILLIAM (1803-57), English writer, was born at London, Jan. 3, 1803. After the production of his first comedy in 1821 he wrote regularly for the theater, and fame came in 1829 with *Black-Eyed Susan.* Among his other plays are *The Bride of Ludgate* and his one tragedy, *The Painter of Ghent.* Jerrold was on the staff of *Punch* from 1841 until his death and contributed to it his popular *Mrs. Caudle's Curtain Lectures.* He died at London, June 8, 1857.

JERSEY, the largest of the CHANNEL ISLANDS, lying about 40 mi. off Brittany and a British possession. Its greatest length is about 11 mi.; greatest breadth, 7 mi.; area 44.87 sq. mi. The coast, particularly on the north, is extremely rugged and precipitous, is deeply indented all round and has a number of good harbors, chief of which are St. Aubin and St. Helier. The island is fertile, abundantly wooded and well-cultivated. The climate is mild and agreeable. Wheat is the principal cereal raised, and large quantities of fruits and vegetables are exported to the London market. Dairy cattle of the famous Jersey or Alderney breed are reared and shipped in large numbers to many parts of the world. The purity of the breed is maintained by careful official registration and the stock fetches high prices from breeders in Australia, England, Canada and the United States. St. Helier is the principal town. Pop. 1921, 49,701; 1931, 50,455.

JERSEY CITY, a city, port of entry, and the county seat of Hudson Co., N.J., situated on the west side of the Hudson River opposite lower Manhattan Island, N.Y. It is bounded on the east by the Hudson River and Upper New York Bay and on the west by the Hackensack River and Newark Bay and is contiguous with Bayonne to the south and Hoboken and Union City to the north. With the exception of "Bergen Hill," a ridge approximately a mile wide and at places 200 ft. in height which traverses it

longitudinally, the site is level and consists largely of land reclaimed from the rivers and bays. It is an important railway center and water shipping point, having 11 mi. of water front, much of which is occupied by docks, and being the terminus of the Pennsylvania, Baltimore and Ohio, Central of New Jersey, Erie, Lehigh Valley and Reading railroads, and numerous steamship lines. It is also served by the Hudson and Manhattan tubes which afford direct passenger connections to both downtown and midtown Manhattan, ferries, trolleys and extensive motor bus lines including those operating through the Holland tunnel, of which Jersey City is the western terminus.

Jersey City is an important manufacturing, trading, and warehousing center. According to the Census of 1930 the city's manufactured products for 1929 were valued at about $318,000,000; these included railroad equipment, electrical and radio supplies, sugar, meat products, cigars, cigarettes, soap and toilet articles. There were 356 wholesale establishments with a total trade amounting to $208,869,895 and 4,371 retail stores with net sales of $120,973,315.

Jersey City was settled in 1633. It was incorporated as a separate town from Bergen Township in 1838 and as a city in 1855. It has the commission form of government. Pop. 1920, 298,103; 1930, 316,715.

JERSEY SHORE, a borough near central Pennsylvania, in Lycoming Co., situated on the Susquehanna River, 12 mi. southwest of Williamsport; served by two railroads. Grain, potatoes and tobacco are the chief crops of the region. The borough has silk mills and railroad shops. Jersey Shore was founded in 1785, incorporated in 1826. There are large tracts of forest and hunting grounds under state control in this region. Pop. 1920, 6,103; 1930, 5,781.

JERUSALEM, the capital and principal city of southern Palestine. In Moslem hands since 1244, and under Turkish rule since 1517, the city surrendered to British forces Dec. 9, 1917. The latest census, taken in 1922, gave Jerusalem a population of 62,678, which is composed of Moslems, Jews and Christians. The religious head of the Moslems is the Grand Mufti of Jerusalem, president of the Moslem Supreme Council. The Jews have two chief Rabbis, one for the Sephardim Jews and one for the Ashkenazim Jews. There are in addition three Christian Patriarchs, Orthodox, Latin and Armenian. The government maintains 310 schools, in which the majority of students are Moslems. The Christian and the Jewish communities maintain their own educational facilities. The Hebrew University, situated on Mt. Scopus, in Jerusalem, was opened Apr. 1, 1925. A new museum was under construction in 1930, the funds for which had been donated by John D. Rockefeller, Jr.

Jerusalem is the site of many famous ancient religious edifices, and it is visited by large pilgrimages of worshippers. The site of Solomon's Temple is occupied by the Mosque of Omar, in which are a relic of Mahomet and sacrificial stone of Abraham. There is also the Church of the Holy Sepulchre; Via Dolorosa, the road along which Christ is believed to have walked while going to Calvary; the Wailing Wall; Coptic and Franciscan monasteries and a Greek monastery; and 70 Jewish synagogues. At Bethlehem, 5 mi. away, is the Church of the Nativity, said to be the oldest Christian church in existence. The city of Jerusalem is surrounded by a towered wall built in the early 16th century on the site of that which fortified the city during the times of the Crusades. Jerusalem has had a most eventful history as the Holy City of three important faiths. The ancient Canaanites had already built Jerusalem before the advent of the Hebrews and, as the Tel-el-Amarna letters show, they had already called it Jerusalem, meaning "city of peace." Thereafter, Jerusalem shared the fate of Palestine, was conquered and reconquered successively by the Hebrews, the Egyptians, the Assyrians, the Babylonians, the Persians, the Greeks and the Romans in the course of its many thousands of years of existence, being destroyed in 70 A.D. by the Romans. It was gradually rebuilt and conquered by the Moslems and then by the Christian Crusaders before finally falling into the hands of the Turks. After the Balfour Declaration in 1917, which assured the Jews of the reconstruction of their old homeland, Jerusalem has rapidly advanced and is now a promising city. Pop. 1931, 90,407.

JERUSALEM, KINGDOM OF. As the First Crusade approached Syria, some leaders began to undertake expeditions of personal conquest. Early among these was a venture of Baldwin, younger brother of Godfrey of Bouillon, who turned aside into the upper Euphrates valley at the invitation of the Armenian prince of Edessa, who was a Christian. The latter adopted Baldwin as his heir, and when, in 1098, the prince was murdered, Baldwin succeeded to his county, took an Armenian wife and ignored the crusade. This first crusader state was always weak, having very few Europeans and being dangerously exposed to Moslem attack by its geographical position.

When the crusade reached Antioch, both Bohemund and Raymond desired the city. The Norman persuaded the other leaders to promise the place to him if he could gain possession. Since he was already in touch with a traitor within he promptly arranged the city's capture. When the army advanced to Jerusalem Bohemund remained behind to subjugate his new principality. The Byzantine emperor laid claim to Antioch, and the later Comneni did assert their suzerainty at times over Bohemund's successors. Raymond, excluded from Antioch, turned to the next county to the south, but Tripoli its chief city was not taken until 1109, after Raymond's death.

When Jerusalem was captured there was some idea of forming an ecclesiastical state under the Patriarch. In conformity with this Godfrey of Bouillon accepted the position of "advocate of the Church of the Holy Sepulchre." But when, during the next year, Godfrey died, his brother Baldwin of Edessa, succeeding to Jerusalem, assumed the title of king and founded

the Latin Kingdom of Jerusalem. In a sense this term may be said to embrace the four crusader states in Syria inasmuch as Antioch, Edessa and Tripoli recognized a vague overlordship of the Latin king, although acting on all occasions with characteristically feudal independence. Indeed the kingdom was one of the most completely feudal states imaginable. It had been created by feudal nobles and organized according to their ideas. The king, consequently, was never more than a feudal superior among his barons.

Since the numbers of Franks was always small and the Syrian territory never completely subdued, the crusaders, especially those of the generation following the First Crusade, adopted a policy of conciliation towards the native population. They needed the continued aid of the Italian cities and gained it by commercial concessions to the Venetians, Genoese and Pisans which tended to give these merchants tax-free monopolies stimulating to commerce but bringing no revenue to the kingdom. In adapting themselves to their new surroundings the crusaders forgot their religious fanaticism and learned the cultivated habits of the east, a change which often scandalized zealous pilgrims from Europe. For 200 years the crusader state maintained a precarious existence. Its weaknesses were those of feudalism and of inadequate European settlement under unfavorable conditions. Even after 1291 the title King of Jerusalem continued in use, and in recent times it has been borne by Austrian, Spanish and Italian rulers.

R. A. N.

JERUSALEM DELIVERED (*Gerusalemme Liberata*), an Italian epic in 16 cantos, of the First Crusade, by TORQUATO TASSO; published 1580. Godfrey of Bouillon is before the walls of Jerusalem, but is powerless without Rinaldo, who has succumbed to the charms of Armida, the witchlike emissary of the king of Damascus. Rinaldo at length is separated from his enchantress and rejoins the Crusaders, Armida fleeing to Egypt with angry vows to have revenge. But the two lovers are again brought together, and the poem closes with the Crusaders' majestic entry into the Holy City. The loves of Tancred and Clorinda and of Olindo and Sofronia form two minor episodes. The finest English translation of this superb poem is perhaps that by Sir Edward Fairfax, 1600.

JESSAMINE (*Gelsemium sempervirens*), a smooth, climbing, evergreen shrub of the logania family called also yellow jessamine and Carolina jasmine. It is a native of woods and thickets from Virginia to Florida and Texas, southward to Guatemala, often cultivated as a porch and conservatory plant. The slender trailing stems, sometimes 20 ft. long, bear narrow pointed leaves, showy, bright-yellow, trumpet-shape flowers and small thin pods containing very flat seeds. The flowers emit a pleasing fragrance similar to that of the true jasmine (*Jasminum*). All parts of the plant are very poisonous, especially the root, which is the source of the powerful drug gelsemium, sparingly used in modern medicine.

JESSUP, WALTER ALBERT (1877-), American educator, was born in Richmond, Ind., Aug. 12, 1877. He studied at Earlham College and at Columbia. From 1900-09 Jessup was superintendent of



COURTESY U.S DEPT OF AGRIC

YELLOW JESSAMINE

schools successively at Westfield and Madison, Ind. In 1912 he was made dean of the school of education at Indiana University, and the next year became dean of the college of education at Iowa State University, of which he was elected president in 1916.

JESUITS, a designation for the Society or Company of Jesus, credited to John Calvin, who about 1550 so referred to the members of the order founded by ST. IGNATIUS LOYOLA (1491-1556), and denominated by him *Societas Jesu.* The order was established in 1534 and confirmed by Pope Paul III in 1540. When its founder died in 1556, it had over 1,000 members, including many notable missionaries, such as St. Francis Xavier, an early disciple of Loyola. Membership in the order is open to both priests and laymen, and is classified in six grades: novices, temporal coadjutors, approved scholastics, spiritual coadjutors, those professing three vows and those professing four vows. The last is the most influential grade and forms the general congregation of the order, from which are chosen those who undertake the most important missions and fill the highest offices. This sixth group also elects the general of the order, who retains the honor for life. Ever since its establishment, the Society of Jesus has met with persecution, as the following summary of history relating to the order shows. It was expelled from France in 1594, but restored in 1603. In 1656 it was engaged in a violent struggle with JANSENISM. In 1764, it was again expelled from France, and three years later from Spain. When Avignon was ceded

to Pope Clement XIV in 1773, the order was suppressed until it was reestablished by Pius VII in 1814. In 1872 it was expelled from Germany; the next year its colleges and convents in Rome were suppressed, and in 1880 France forcibly closed all its religious houses. The missionary work of the order in South America, China and elsewhere is one of the greatest religious and educational adventures and successes known.

JESUIT'S NUT, a name applied to the WATER-CHESTNUT, an aquatic plant bearing a nutlike fruit which in some parts of the Old World is roasted and eaten like the chestnut.

JESUS, the Founder of the Christian faith. The New Testament contains four accounts of his life entitled MATTHEW, MARK, LUKE and JOHN which may be read conveniently in any Harmony of the Gospels. Jesus is presented as the Hebrew Messiah, equivalent to the Greek word Christ, or anointed Saviour of mankind. In the Old Testament, numerous prophecies are held to refer to him, instances being Genesis 3:14-15, Psalms 22, Isaiah 9:1-7, and 53. In any aids to the study of the Bible these forecasts are enumerated. The date of Christ's birth was several years before the usually reckoned opening of the Christian Era; possibly, it was as early as 9 B.C. According to the sacred narrative, he was conceived of the Holy Ghost and born of the Virgin Mary, at Bethlehem, where his nativity was announced by angels to shepherds, who worshiped the Babe. Also he was taken to the Temple at Jerusalem and duly dedicated.

After an interval of nearly two years, wise men, or magi, who had seen his star in the East, visited the child and brought gifts. Alarmed by this homage to one described as King of the Jews, Herod ordered the massacre of the Innocents, that is, of young children at Bethlehem. Joseph, the husband of Mary, fled with the Holy Family, therefore, to Egypt, remaining in exile until the death of Herod. They then returned but, hearing that Herod had been succeeded by his ruthless son, Archelaus, avoided Judea and settled at Nazareth where Jesus lived until he was 30 years old. Of his upbringing, there are apocryphal accounts. One incident alone is mentioned in Scripture, his visit at the age of 12 years to Jerusalem where his understanding astonished the doctors or rabbis in the Temple. Allusion is made to Jesus as a carpenter, and presumably it was by this trade that he helped to maintain Mary's home.

Baptism by John. When John the Baptist drew crowds to the River Jordan by preaching repentance, Jesus left his seclusion and submitted to baptism. In the form of a dove, the Holy Spirit descended on him, after which he endured 40 days of fasting in the desert or highlands, a period which recalls the 40 days spent by MOSES on Mount Sinai. The ordeal included a threefold temptation by the Devil. Restored to strength by the assistance of angels, Jesus returned to the Jordan and began the three years of his public ministry.

The chronology of this period cannot be here elaborated. It is not exactly recorded nor is it significant. For a time, Jesus assisted John in his mission. But John himself declared that a greater than he had come, and when the Baptist was beheaded by Herod Antipas, it was to Christ that the movement turned for leadership. At Nazareth, he preached in the synagogue but was violently rejected. He proceeded, therefore, on tours through the towns and villages, particularly around the Lake of Galilee, spending much time at the prosperous city of Capernaum but also crossing the Jordan to the east and making his way northwards to Tyre and Sidon. The manner of his teaching was informal. He would speak in a house, on the slope of a mountain, from a boat on the lake, or by the wayside. Frequently he was heard by crowds, but some of his greatest sayings were uttered in conversation to individuals, like Nicodemus, the ruler of the Jews, who came to him by night, or the woman of Samaria whom he met at Jacob's well. To children, he was tender, and they were constantly with him. Women of notorious character, for instance, Mary Magdalene, found him to be a friend in need, and what in these days one would call the underworld gathered to hear him. To publicans or tax-gatherers against whom, as agents of Rome, there was a prejudice, he was sympathetic. On a number of occasions, he attended the Hebrew feasts at Jerusalem and entered into argument with the priests and rabbis who gathered in the Temple.

Jesus, the Man. The evidence is that, in body, Jesus was a normal man. He never suffered illness, but he ate, drank, was weary and slept. Of his personal appearance, we know nothing except by pictorial tradition according to which he is depicted with a beard. His eye was compelling, his voice was resonant and his manner was grave. There is no record that, at any time, he smiled or laughed. Twice he wept, at the tomb of Lazarus and over a doomed Jerusalem; and in the Garden of Gethsemane, mental agony caused his sweat to fall like drops of blood. At times he had no leisure for meals, but despite such stress he would devote the night to prayer. He wore one flowing robe and an inner garment, woven throughout of wool, and when crucified, these were his only property. It is clear from several incidents that, during his ministry, he carried no money. On the other hand, an accusation against Jesus was that he failed to live as an ascetic. On numerous occasions, he accepted hospitality at comfortable homes, and among those who thus became his hosts were Zacchaeus and Matthew, the tax-gatherers, Simon the Pharisee, and Lazarus of Bethany, with his sisters, Martha and Mary. It was at suppers so provided that, on two occasions, a woman approached his feet, one shedding her tears, and the other, Mary of Bethany, breaking over him her alabaster box of precious ointment.

Claim of Messiahship. Once only, when an adulteress was brought to him for judgment, it is recorded that Jesus wrote; and then it was with his

finger on the ground. The record of his utterances depends, therefore, on oral reminiscence, and the sayings are gathered into numerous discourses of which the Sermon on the Mount, containing the Beatitudes and the Lord's Prayer is an example (Matthew 5-7). It was the testimony, even of his opponents, that never man spake as did he, for which testimony, three reasons may be assigned. First, his words, for instance, "God is a spirit," were simple and direct. Secondly, he illustrated his meaning with exquisitely apt allusion, elaborated at times into an incomparable series of parables, of which 40 have been listed, including the Good Samaritan, and the Prodigal Son. But the third and most challenging element in his teaching was authority. If he quoted from the Hebrew Scriptures, it was in order to add, "But I say unto you," and, habitually, he used the expression, "Verily Verily" or "Amen Amen" in the original text, which asseveration is an appeal to Deity. In discussing Hebrew ritual or Rabbinic tradition, he insisted on a personal supremacy which he expressed in the challenging declaration, "The Son of Man is Lord also of the Sabbath." Even more arresting were his statements, "I am the Light of the World, I am the Bread of Life, I am the Good Shepherd, I am the True Vine, I am the Way, the Truth and the Life"; and others similar to them.

According to the record, the teaching of Jesus was fortified by miracle. The four Gospels suggest that these acts of power were very numerous, especially during the earlier periods of the ministry, but the number of miracles, actually described, appears to be 36. Of these, 23 were miracles of healing and include cases of leprosy, dropsy, epilepsy, fever, paralysis, hemorrhage, crippled limbs, a wounded ear and the blind, deaf and dumb. In three instances, Jairus's daughter, the widow's son at Nain and Lazarus, a dead person was raised to life. Eight of the other miracles were applied to nature. There was the water turned to wine at the marriage feast of Cana. There were the 4,000 and the 5,000 fed by loaves and fishes miraculously multiplied. There were wonderful draughts of fishes, the stilling of storms on the Lake of Galilee, and Jesus walking on the water. Finally, we have Our Lord passing into safety through an angry crowd at Nazareth and his curse on the barren fig tree. Whatever view be taken of these narratives, they constitute a claim to personal power over creation, animate and inanimate.

Hostility of Jews. The authority, so claimed by Jesus, aroused opposition. Concentrated in Jerusalem, this hostility was inflamed by the severity with which Jesus denounced the hypocrisies and abuses of a religion that emphasized externals like the ceremonial washing of hands and the wearing of phylacteries or little boxes containing words of the law. The conflict, though fought at times on details, was really a struggle over the supreme issue, whether or not Jesus was the Messiah and Son of God. To the Jews of all parties, Pharisees, Sadducees and Herodians, this was blasphemy, a crime deserving of death, and to bring about that end became their burning and relentless desire.

With such a situation gradually developing, the insight of Jesus into men's minds enabled him to avoid any idea of entrusting his cause to a merely popular approval. He selected 70 evangelists, sent them forth to preach, and rejoiced in their success. But he relied chiefly on 12 apostles (*see* APOSTLE), chosen with great care and constantly remaining near his person. Even within the apostolic body, small though it was, there were three, Peter and the sons of Zebedee, James and John, who were admitted to a special intimacy. It was this companionship that led up to Peter's great confession that Jesus was the Christ, the Son of the Living God, which declaration was followed immediately by a memorable experience. Taking with him the three leading apostles, Jesus ascended a mountain, reputed to have been Hermon, but possibly Tabor, where, glowing with mystic light, he was transfigured before them. Moses and Elijah appeared, talking with him, but, after a cloud had enveloped them, it was Jesus who remained. To the final drama, this scene was the prelude.

Prophecy of Death. From this time onward, Jesus told his disciples plainly that he expected to die. It was in vain that Peter protested against the foreboding, and a gloom fell upon the little procession as it passed through Jericho on the way to Jerusalem where the Feast of the Passover was approaching. On what corresponds to Palm Sunday of Holy Week, Jesus, seated on an ass, was acclaimed by the people and so entered the city, but retired that night to the house of Lazarus at Bethany. On the following Monday, he drove the money-changers and merchants out of the Temple, and the two following days were devoted to utterances that included parables, denunciations and predictions of ominous solemnity. During those days, JUDAS ISCARIOT, who acted as treasurer for the disciples, went to the Sanhedrin, then in session, and agreed that, for a payment of 30 pieces of silver, he would enable the authorities to arrest Jesus quietly and without arousing the resentment of the people. With this treachery arranged, Jesus and the 12 disciples proceeded to an upper room in Jerusalem where, on the Thursday evening, they kept the Passover. It was on this moving occasion that Jesus washed the feet of the Apostles, instituted the Lord's Supper of bread and wine, and gave the sop to Judas who immediately left the company in order to fulfill his purpose. Having sung a hymn, Jesus and the Apostles proceeded to the Garden of Gethsemane, there to pray. Judas appeared with armed men and indicated Jesus by a kiss. The Saviour was arrested and early on Friday morning was brought to trial before the Sanhedrin, hurriedly convened for the purpose. He was condemned, and taken to Pilate, the Roman governor who endeavored vainly to transfer jurisdiction to Herod Antipas who had killed the Baptist. Herod allowed Jesus to be crowned with thorns and returned him to Pilate who, still hoping

to save him, applied the scourge. The Jews demanded that, on their feast day, Barabbas, a robber should be released, and warned Pilate that he would not be Caesar's friend if he acquiesced in the claim of the Christ to be King of the Jews. Despite a warning from his wife, who had been troubled by a dream, Pilate, dramatically washing his hands in water, delivered Jesus to be crucified.

His Crucifixion. Jesus was taken along a street still called the Via Dolorosa, and a stranger, Simon of Cyrene, was compelled to bear his cross. At Golgotha, the place of a skull, or Calvary, he was crucified between two thieves, one of whom was moved to repentance. The crucifixion itself began at twelve o'clock and for three hours there was darkness. At three o'clock, Jesus died, and according to Matthew there was an earthquake in which the veil of the Temple was rent. In remorse, Judas returned his bribe to the priests and violently committed suicide. John had taken Our Lord's mother from the Cross to his home, and the other Apostles had fled from the scene. But Joseph of Arimathea, who had completed a new tomb for his family, obtained permission from Pilate to bury the body of Jesus therein, and, in this task, Nicodemus assisted him by bringing spices. The tomb was sealed by the authorities and guarded by soldiers. Early on the following Sunday, the tomb was visited by certain of the women who followed Jesus and found it to be empty. During the weeks that followed, appearances of Jesus in bodily form were recorded, including his final ascension from the Mount of Olives. P. W. W.

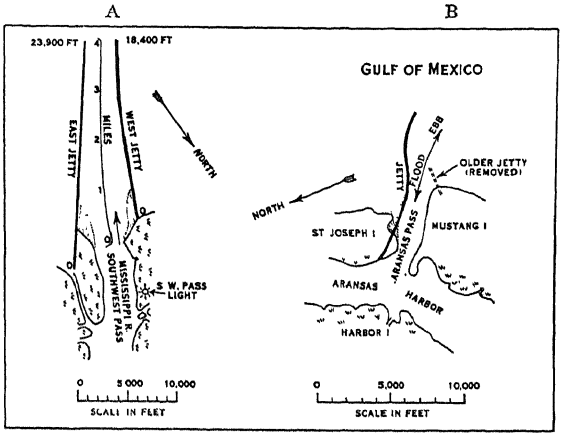
JET, a hard, compact, black variety of BROWN COAL used in jewelry, especially for mourning jewelry. It is homogeneous and tough, and takes a good polish. ANTHRACITE from the Pennsylvania mines and CANNEL COAL from Scotland are sometimes used in place of jet, and imitations are made of OBSIDIAN, glass and black QUARTZ. Jet has been used since prehistoric times for amulets and beads, and ornaments of this material have been found in the cave deposits of paleolithic man and among the remains of the American Pueblo Indians. Jet comes from England, Spain, France, Germany and the United States. *See also* GEM STONES.

JETTIES, structures extending into a body of water, and used as PIERS, MOLES or BREAKWATERS, or to control currents. In America the word is rarely used in the above sense, but to cover structures extending into deep water at inlets, HARBOR entrances and river mouths to direct currents, prevent formation of shallow bars and to facilitate and protect navigation.

Jetties are laid out to meet natural conditions. "Twin" jetties, one on each side of an inlet, generally serve best. Under special conditions, single, curved or straight jetties are used with varying degrees of success. These are usually placed on the windward side of the entrance and bring inlet and shore-wise currents, with their drift, together in deep water. Curved jetties usually have their convex side toward the prevailing wind. The construction of jetties is similar to that of breakwaters. *See also* GROINS; DIKES; PROTECTION, SHORE. F. R. H.

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JEVONS, WILLIAM STANLEY (1835-82), British economist and logician, was born at Liverpool,



TYPES OF JETTIES
A, *Twin jetties.* B, *Single jetty*

Sept. 1, 1835. After graduating from University College, London, he was appointed in 1853 assayer to the new mint in Australia, and spent five years in Sydney. He published *A Serious Fall in the Value of Gold* in 1863, *Pure Logic; Or The Logic of Quality Apart from Quantity* in 1864, and *The Coal Question* in 1865. In 1866 he became professor of logic and political economy at Owens College, Manchester, and in 1876-80 was professor of political economy at University College, London. Jevons maintained that economics should be studied as a mathematical science, and his own system of political economy was based on the so-called "theory of utility." His *Theory of Political Economy* was published in 1871. His chief works in logic were *The Substitution of Similars,* 1869, and *The Principles of Science,* 1874. He was drowned while bathing at Hastings, Aug. 13, 1882.

JEW, designation for an adherent of the Jewish religion, or JUDAISM, to-day. The use of the word Jew as an adjective is altogether incorrect; the correct adjectival form is Jewish. The Jews of to-day are distinguished from other groups or so-called groups of mankind only in religion. Ethnically and racially they do not form either a separate race or a separate nation, but are part of the white race, since all races are distinguished from each other only on the ground of color. Ever since the dispersal of the Jews throughout all the countries of the world, beginning with the destruction of the Second Temple at Jerusalem in 70 A.D., they have ceased to be a separate nation, having lost their own land. They are merely members of that religious community which is known as Judaism, just as adherents of the Christian religion are at the same time Christians and citizens of the country in which they happen to be born or reside.

It is as absurd and as erroneous to talk of the Christian race and the Christian nation as it is to talk of the Jewish race or the Jewish nation.

Up to 70 A.D., in Biblical and post-Biblical times, the Hebrews, or Jews, belonging to the Semitic branch of the white race, to which branch such peoples as the Arabs, Babylonians, Phoenicians, Syrians and Assyrians likewise belonged, had their own country, Palestine, called originally Canaan. Ever since 70 A.D., however, their original land was in the possession of others, and is still subject to the mandate of Great Britain. Hence the Jews ceased to be members of a nation or citizens of a country which no longer existed, but became, as they now are, the adherents and devotees of the Jewish faith.

In Biblical times the designation employed for the Jews was Hebrews or Israelites; the members of the tribe of Judah, of the Southern Kingdom, were called, specifically, the children of Judah. After the destruction of the Northern Kingdom by Shalmaneser, King of Assyria, in 722 B.C., and the disappearance of the LOST TEN TRIBES, at the end of the Babylonian Exile, all the members of the nation (Southern Kingdom) who returned from the Exile were called *Yehudim,* or Jews (Aramaic, *Yehudaye,* or men of Judah). The nation itself was called Judah. The designations Israel and men of Israel were used in such late books as Ezra and Nehemiah side by side with the terms Jews and Judah. (Ezra 4:1, 4; 4:12; 5:1; Nehemiah 1:2; 2:16, etc.)

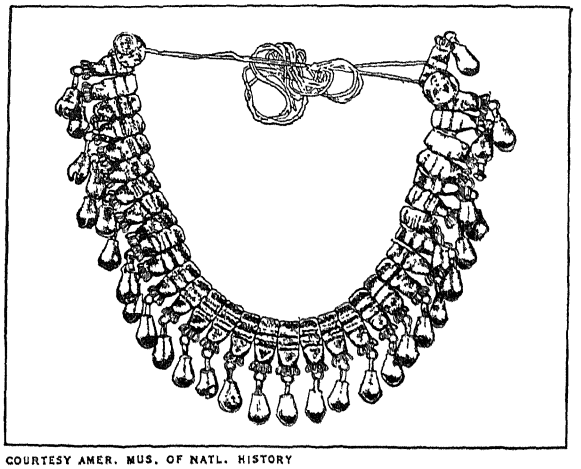
After the Roman conquest of Palestine, from 70 to 135 A.D., the inhabitants of Judah were called Judaei by the Romans, which is merely a Latin adjective or noun formed by adding the Latin adjectival ending *us* to the word *Yehuda* (*Yehudim*), which the Romans shortened by making it a word of two syllables (*Jehuda, Jehudaeus, Judaeus,* plural, *Judaei*). In Greek this form became *Ioudaioi* (plural; singular, *Ioudaios*); from these two words are derived, through slight successive linguistic shortenings and changes, both the German *Jude* and the English Jew, through the Old French *Giu,* which was formerly written *Juieu.* The first mention of the term Jews in an English work is that in the Lambert *Homilies,* 1175.

A. SH.

See M. Fishberg, *The Jews,* 1911.

JEWEL CAVE, a national monument in Custer Co., southwestern South Dakota. A tract of about 1,280 acres was set aside as a government reservation Feb. 7, 1908, under the administration of the Department of Agriculture. The cavern is of limestone formation and consists of a series of chambers, domes, and side galleries connected by narrow passageways. The monument is on an unimproved road 15 mi. west of Custer, S.D., which is on the Chicago Burlington and Quincy railroad and on U.S. Highways connecting with WIND CAVE NATIONAL PARK and FOSSIL CYCAD NATIONAL MONUMENT.

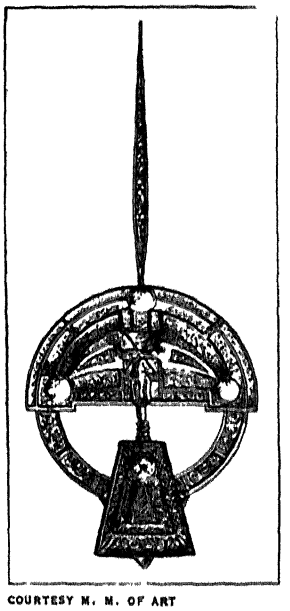
JEWELRY, a term applied to all personal ornaments of gems, precious metals and the like, however made or worn. Historically, jewelry appears to be unique. It is the only thing in the world which has been at once useless and universal; no stage of man's development appears to have been so primitive as to leave unsatisfied the desire for personal adornment. The art of making jewelry has been developed



COURTESY AMER. MUS. OF NATL. HISTORY

ZAPOTECAN GOLD NECKLACE FROM OAXACA, MEXICO

in almost all countries and almost all civilizations to a point of exquisite delicacy and beauty in design, material and workmanship. Strictly, jewelry has not been entirely inutile in function, since brooches developed from the necessity for fastenings, and such adornments as necklaces and pendants had an early talismanic value; nor has it been quite universal, since it has never been popular in Japan. With these exceptions, however, the two adjectives may be applied to it with justice.



COURTESY M. M. OF ART

BROOCH OF BRONZE, 11TH CENTURY

The original is in the National Museum, Dublin

Primitive man's adornments were naturally simple, coarse and easily made; they go back to the early Stone age. The ancient civilizations, however, produced beautiful jewelry. The Egyptian discoveries are especially rich and some of the work found in Egyptian tombs may be dated almost 6,000 years before Christ. Early Greek jewels unearthed at Mycenae belong to the period 1600-1400 B.C., but the finest Greek work, with delicate filigree and enamel, was done about 1,000 years later. Assyrians and Babylonians also made beautiful jewelry. Chinese jewelry, with its cabochon stones, its carved jade and enamel on silver, has always shown great delicacy. The Romans of the days of the Empire used large



COURTESY METROPOLITAN MUSEUM OF ART

CHINESE JEWELRY

Silver inlay ornaments of the T'ang Dynasty (7th-10th centuries).

cut gems with plainer surfaces of metal. The barbarian peoples of Europe, developing into nations, had their own jewelry which came to be influenced, of course, by Rome and Byzantium. One of the most famous of such pieces is the "Alfred jewel," of cloisonné enamel on gold, marked in Saxon "Alfred ordered me to be made." This was found in the year 1693 near the place where King Alfred fled from the Danes in 878, and is now in the Ashmolean Museum at Oxford. Another celebrated early European jewel is the crown of the 7th century Visigoth king Reccesvinthus, also cloisonné, with pearls and cabochon gems in fretted gold. Discovered near Toledo, it is now in the Cluny Museum in Paris.

In the early centuries of Christianity, jewelry often had religious significance; at an early date it was made in monastery workshops. The cross was a frequent subject for decoration. In the 14th and 15th centuries costume increasingly claimed jewelry as its handmaiden. During the Renaissance, which brought a wider use of color in jewelry, religious motifs became less popular, and personal and sentimental symbols often took their place; pieces of jewelry continued, however, to be largely expressive of ideas. At this period, under the influence of BENVENUTO CELLINI in Italy and also in France, especially fine work was done in design. Gold traceries and enamels were also exquisite. It is interesting to note that the diamond was considered less fine and was less popular than the ruby and emerald. In the 17th and 18th centuries jewelry was beautifully made, but lacked the creative artistry in design of earlier periods; and in the 19th century it became more stereotyped. This century, however, saw the rise of the diamond to its modern popularity.

With the end of the 19th and beginning of the 20th century creative vigor came back to the art of jewelry-making. The name most notably associated with this revivification is that of René Lalique, who started a new movement in Paris and whose "new art" jewelry became world-famous. At the same time other jewelers, seeking new inspiration, returned to classic styles which should serve not as patterns to be slavishly copied, but as a stimulus to creative work. Generally, the jewelry of the 20th century has been marked by the use of platinum, the renewed popularity of pearls, the rich and varied use of color and an emphasis upon beauty and originality in design, to meet which the jewels are sometimes cut. Inexpensive pieces, known as costume jewelry, also have become popular; these are made with semiprecious or artificial gems, but with good design and workmanship and in attractive and varied colors. The ARTS AND CRAFTS movement has had a significant part in the modern revival of interest in handmade jewelry.

Magnificent collections of jewelry are contained among the Crown Jewels of the various European countries. Probably the most magnificent was the collection of the Crown Jewels of Russia. The oldest crown in existence is that of the Emperor Charlemagne, which is in the Louvre in Paris; the crown of Hungary is of the 10th century. Most of the Crown Jewels of France have been sold The splendid collection of the Crown Jewels of England is on public exhibition in the Tower of London, the only Crown Jewels which are publicly shown.

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JEWELRY INDUSTRY, UNITED STATES. This industry comprises establishments engaged in manufacturing articles chiefly for personal adornment, made for the most part of precious metals, either plain or engraved and with or without precious or semiprecious stones. Five-sixths of the jewelry manufactured in 1929 was produced in New York which contributed 34.3% of the total output; Rhode Island, 23.6%; Massachusetts, 15.8%, and New Jersey, 9.7%.

JEWELRY MANUFACTURES, U.S., 1899-1929

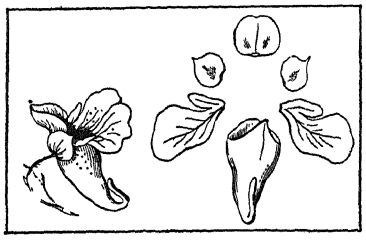
Year	*No. Establishments*	*Wage Earners*	*Wages $*	*Value of Products $*
1899	851	20,468	10,643,887	46,128,659
1904	1,023	22,080	12,592,846	53,225,681
1909	1,537	30,347	18,357,950	80,349,874
1914	1,914	28,289	18,301,565	81,006,289
1919	2,054	30,871	35,863,718	203,939,230
1925	1,468	23,837	35,177,020	166,816,370
1929	1,536	27,922	38,979,810	177,386,932

JEWELS OF THE MADONNA, THE, an opera in three acts by ERMANNO WOLF-FERRARI, libretto after the composer's plot by Zangarini and Golisciani; première (as *Der Schmuck der Madonna*), Berlin, 1911, London, Chicago and New York, 1912. The Italian title is *I Giojelli della Madonna*. It is the most successful of Wolf-Ferrari's several operas.

During the festival of the Madonna, a bedecked effigy of the Virgin is carried through the streets of Naples while the crowds of worshippers, in a state of mingled awe and gayety, chant hymns and cheer. Maliella, a waif adopted by Carmela, gazes with reverence at the jeweled figure which is passing. Rafaele, protesting his love, swears in a whisper that he would steal the Madonna's jewels and give them to Maliella in order to prove it. She shudders at the sacrilege, but nevertheless is moved by his ardor. Gennaro, a young blacksmith, is also in love with Maliella. Hearing of Rafaele's promise, the swarthy son of Carmela determines to outwit his rival. He therefore steals the jewels and takes them to his sweetheart, and so overpowers her with his love that, for one mad hour, she mystically believes the man is Rafaele. Rafaele, who had worshipped Maliella for her innocence, is horrified when the girl confesses her infidelity, and curses her. In a frenzy of remorse she drowns herself while Gennaro, overwhelmed with grief, plunges a knife into his heart.

JEWELWEED, the name given to various species of *Impatiens*, a very numerous genus of succulent herbs of the jewelweed family (*Balsaminaceæ*). There

are some 500 species native chiefly to tropical regions, two of which are common wild flowers in eastern North America. The spotted touch-me-not (*I. biflora*), a smooth annual 2 to 5 ft. high, bears nodding,



PALE JEWELWEED OR TOUCH-ME-NOT
Flower, showing sack and spur. Flower parts, showing calyx and corolla, displayed

orange-yellow, spurred flowers mottled with reddish brown. The similar but larger pale touch-me-not (*I. pallida*) bears pale-yellow flowers.

JEWESS, THE, an opera in five acts by JACQUES FRANÇOIS HALÉVY, libretto by Eugène Scribe; première, Paris, 1835. Since then it has been produced at long intervals, never acquiring wide popularity but nevertheless remaining in the standard repertory. It is also known by its French title, *La Juive.*

Pretending that he is a Jewish artist, and taking the name of Samuel, Prince Leopold courts the beautiful Jewess Rachel, daughter of Eleazar. The latter, however, discovers Leopold is a Christian. Forbidden the house, he takes Rachel with him even though he is betrothed to the Princess Eudoxia. When Rachel learns this her jealousy is aroused and, in order to wreak revenge upon her noble lover, she names him as her seducer. Rachel is cast into prison while Leopold is banished by the Church. Eudoxia prevails upon Rachel to retract her statement which, being done, lightens the sentence passed on Leopold; but the Jewess and her father are condemned for conspiring against a Christian and, in accordance with fifteenth-century Christian law, they are plunged into a cauldron.

JEWFISH, a name given to various sea-basses of immense size widely distributed in warm oceanic waters. They are of robust form with broad heads and rough-scaly bodies, often exceeding 6 ft. in length and 500 lbs. in weight. Though interesting to anglers by reason of their huge size, jewfish are too sluggish to be classed as true game fish.

The spotted jewfish (*Promicrops itaiara*), of both coasts of tropical America, ranges northward in the Atlantic to Florida. It attains a length of 8 ft. and sometimes weighs nearly 700 lbs.; its flesh is sold for food in Florida markets. Nearly equal in size is the black jewfish (*Garrupa nigrita*), known also as black GROUPER, found from South Carolina and the Gulf coast to Brazil. The California jewfish (*Stereolepis gigas*), called also black SEA BASS, prized by the Santa Catalina sportsmen, reaches a length of 8 ft. and a weight upwards of 400 lbs. The largest known jewfish (*Promicrops lanceolata*), sometimes 12 ft. long, occurs in the South Pacific.

JEWISH ART. By Jewish art is meant that art practised by the Jews before the Dispersion, the conditions of the Jews thereafter rendering impossible the development of a distinctive art. Indeed, the Jews were scarcely possessed of an independent art even before that period, as their productions were entirely guided or influenced by the arts of other races. They contributed a great deal in other fields of culture, but their artistic productions were few. Chiefly accounting for this is the fact that, from the first, the Jewish artist was condemned to poverty of invention and details by the proscription against images contained in the second commandment of the Decalogue (Exodus 20:21). This pronouncement, which was interpreted as including all representations of the deity and of living beings, men and animals alike, sealed the doom not only of the plastic art, but of the graphic arts as well.

The art of the Jews was almost entirely imitated from that of the Phoenicians, which was in turn borrowed from Egyptian, Assyrian and Babylonian models. That most celebrated architectural monument of Hebrew antiquity, Solomon's Temple at Jerusalem, was largely the work of Phoenician artists and builders (*see* SOLOMON). In comparison to the great structures of surrounding nations, the temple, as restored by Charles Chipiez, proves to be a rather mediocre edifice. In its general plan it was slight and low; rich rather than massive. According to descriptions, its decoration followed Assyrian designs, as in the two cherubim (not "angels" but human-headed wing bulls), which were placed upon the Ark of the Lord. Adorning the porch of the temple were the two famous brazen pillars of Jachin and Boaz, executed by Phoenician workers. The sumptuous structures built by HEROD in later times were frankly copied from Roman architecture.

Religious proscription against image-making precluded the free development of sculpture. Nevertheless, wood- and ivory-carving were popular forms of Jewish art. Wood-carvings decorated the walls and doors of the temple, while the chief decorative feature of Solomon's throne was work in ivory.

The potter's art as practised by the Jews has been traced back to earliest times. Professor W. M. Flinders Petrie, whose excavations at Tell-el-Hesy have brought to light a rich store of pottery, divides this art into three periods, the Amorite, the Phoenician and the Jewish, in which Phoenician influences prevail throughout. The glyptic art also goes back into remote antiquity. Engraving on precious stones was learned from the Canaanites, who received their knowledge of this art from the Phoenicians. Ornamentation on Jewish shields shows the floral and geometric designs of the latter people. Metal-work and overlaying in metal was extensively practised among the Jews, but no remains of this branch of art have been disclosed in modern times.

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JEWISH DIETARY LAWS. The whole of the 11th chapter of Leviticus deals with the dietary laws and tells what the Israelites may and may not eat. The legislator, like the modern zoologist, divides living creatures into quadrupeds, birds, fishes, reptiles and insects. Among quadrupeds only those domestic and wild animals are permitted whose hoofs are cloven and which chew the cud; among fish, only those denizens of the streams and seas that have fins and scales. Of birds, a list of 24 species is given that may not be eaten. As these cannot be identified with certainty the rabbis have laid down the rule that only those fowls may be consumed concerning which there is a clear tradition that they belong to permitted species. Of reptiles and insects only certain classes of locusts are permitted. These laws are repeated in the 14th chapter of Deuteronomy.

Before the Flood, Noah received the command, "Of every clean beast, thou shalt take to thee (into the ark) by sevens, male and female; and of beasts that are not clean by twos, male and female." (Genesis 7:2-3.) When the Patriarch left the ark at the end of a year and 10 days, he "builded an altar unto the Lord and took of every clean beast and of every clean fowl and offered burnt offerings on the altar." (Ibid. 8:20.) The distinction between clean beasts and birds and unclean thus existed at a very early period. Only clean birds and beasts could be offered upon the altar. Otherwise the flesh of all animals was permitted to Noah and his descendants. Up to his time vegetarianism was in vogue. Noah, however, is warned, "Flesh with the life thereof, which is the blood thereof, ye shall not eat." (Genesis 9:4.) Blood was forbidden to be eaten. A limb was not to be torn from the living animal; nor was the flesh to be cut from the quivering flanks and used as food. This may perhaps seem an unnecessary prohibition. But such practices were common in ancient times. Hence the express prohibition.

Purpose of Dietary Laws. The purpose of the dietary laws is clearly set forth in the Bible. "Ye shall not make your souls abominable with any creeping thing that creepeth; neither shall ye make yourselves unclean with them, that ye should be defiled thereby." (Leviticus 11:43.) "Ye shall make a distinction between clean beasts and unclean, and between unclean fowls and clean; and ye shall not make your souls abominable by beast or by fowl or by any manner of living thing that creepeth on the ground which I have separated for you as unclean." "Ye shall be holy unto me, for I, the Lord, am holy. I have separated you from the peoples that ye shall be mine." (Leviticus 20:25-26.) The Jewish people, as God's priests, are to live under special rules and restrictions. They were to curb their appetites and control their desires, not for self-regarding reasons, not from motives of prudence, but for the sake of God.

But the distinction between clean and unclean birds and beasts does not exhaust the dietary restrictions to which the Jew is subject. "Whatever has died of itself ye shall not eat." (Deuteronomy 14:21.) Only flesh of animals killed in a prescribed way may be used by Jews. Beasts or birds not so killed are regarded as having died of themselves. The Jewish method of slaughter is to cut the esophagus, trachea, jugular vein and carotid arteries by one continuous, uninterrupted transverse cut without vertical pressure, with a knife perfectly sharp and smooth, without dent or notch, however minute, and tested by specially trained experts. Cattle and birds not killed in this way are termed Nevelah, meaning "died of itself."

Besides the prohibition of Nevelah, Terefah is forbidden. This term literally means "torn." But the rabbis explain that it connotes any disease or lesions that would cause death. As beasts are particularly liable to pulmonary affections, the lungs of large and small cattle after they are slain are examined in situ and again after removal. Any evidence of disease renders the flesh of the animal unfit for use by Jews. Only within recent years has the communicability of disease from animals to those who consume their flesh been scientifically established and the imperative necessity of meat inspection been recognized. The Jewish people have had such a system of inspection for thousands of years. In the Middle Ages the Black Plague raged in Europe and decimated its population. The Jews enjoyed a singular immunity, which they owed to the dietary and other health laws of their religion.

Preparation of Meats. Two other restrictions have to be mentioned. The flesh of cattle and of fowls has to be soaked in clean, cold water, usually for a half hour, and then sprinkled with salt on all sides and placed on a sloping board or on a board with openings, in order to draw out and drain the surface blood. This process usually lasts one hour. To remove the salt, the meat is then washed clean. Certain portions of fat of domestic cattle, offered up in ancient times on the altar (Leviticus 3:9-10, 16 and 8:25), are forbidden (ibid. 7:23-25). The Bible specially prohibits "seething a kid in its mother's milk." (Exodus 23:19 and 34:26; Deuteronomy 14:21.) This is understood as a prohibition against any joint use of meat cooked with milk. The Jews abstain from eating the sinew of the hip. (Genesis 32:33).

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JEWISH PHILOSOPHY, the result of attempts by the Hebrews to ground Judaism philosophically. Its two great periods fell in the early Christian Era and in the Middle Ages. In the first it was connected with the Alexandrian school (*See* ALEXANDRISTS). At this time Judaism was brought into contact with Greek learning and a syncretism took place. Among the Jewish Alexandrians was Philo (fl. 1st century A.D.), who tried to reconcile Moses and Plato. His doctrine of the logos developed into NEO-PLATONISM and later played an important part in Christian theology.

During the Middle Ages Jewish philosophy was in-

fluenced considerably by Arabian thought. This was not only true of the Kalamists but was equally true of Ibn Gabirol (Avicebron c. 1021-58), the leading representative of Neo-Platonism, and Moses Maimonides (1135-1204), the chief expounder of Aristotelianism. The Kalamists sought to derive God from the existence of the world, thus arguing to a necessary cause. This is the opposite of a creation theory which starts with God from whom the world is derived. The *Fons Vitae* of Avicebron revised the Neo-Platonic conception of matter by asserting that it participated in the various stages of emanation from God. It is not simply the lowest form of being, but itself has several degrees of being, becoming most real as it approaches God. The centenarian Isaac Israeli (c. 845-945) was also a Neo-Platonist. Besides Maimonides, Gersonides (1288-1344) was also a representative of Aristotelianism. *The Guide to the Perplexed* of Maimonides was a systematic reconciliation of Judaism and Aristotelianism and holds an important place in Jewish thought. It was later attacked by the anti-rationalist Crescas (1340-1410) in his *The Light of the Lord*. Maimonides and Crescas gave rise to opposing schools of thought. Earlier among those who did not choose to use reason in connection with religious matters was Judah Halevi (12th century).

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JEW'S-EAR, an edible fungus (*Auricularia auricula-Judæ*) native to Europe and eastern North America. The plant, which grows singly or in small clusters, is composed of an irregular lobe, 1 to 3 in. across, somewhat cupshaped and wrinkled like the outer ear. It is found on tree trunks and fallen logs from August to October.

JEW'S MALLOW, a variety of jute (*Corchorus olitorius*), the young shoots of which are grown as a potherb in India, Egypt and other warm regions, including parts of the southern United States.

JEZEBEL, in Biblical history the infamous wife of AHAB, King of Israel, I Kings 16:31, and a daughter of a priest of the goddess Astarte. Many tales are told of her treacherous character and of her misdeeds, until she finally brought down upon her head the wrath of Elijah, the prophet, who foretold her destruction. Because of her idolatry she is branded as a false prophetess in the Book of Revelations 2:20 and to this day her name is used as a literary synonym for a loose, dissolute and abandoned woman.

JHANSI, the name of a city, district and division in the United Provinces, British India. The walled city, on the Great Indian Peninsula Railroad, is the headquarters of the district and an important trading center. It contains a memorial cenotaph to the 65 Europeans who were massacred there during the Mutiny of 1857. The hilly district of Jhansi which, since 1891, includes the district of Lalitpur, is traversed by the rivers Pahuj, Dhasan and Betwa, and produces wheat, barley, cotton, millet and oilseeds; area 3,634 sq. mi. The division of Jhansi, area 10,440 sq. mi., includes the districts of Jhansi, Banda, Hamirpur and Jalaun. Pop. 1921, city, 66,432; district, 606,499; division, 2,065,297.

JICARILLA APACHE, a division of the Apache, a tribe of the Athapascan linguistic stock. They lived in northern New Mexico in the mountains and valleys on both sides of the Rio Grande. The Jicarilla were divided into two sub-groups, the Llanero and the Ollero. The former lived on the headwaters of the Canadian River and in the mountains separating the Canadian from the Rio Grande; the latter lived along the Chama River. Linguistically they are most closely related to the MESCALERO APACHE. The Jicarilla were nomadic hunters and ranged eastward to western Kansas and Oklahoma and into Texas. They lived in skin tipis much like those of the Plains, and depended more on the products of the hunt, making lengthy trips to the plains for buffalo, than on agriculture. Their costume was strikingly similar to the skin clothing of the Plains Indians; they were indifferent makers of pottery but made distinctive coiled baskets; their social and political organization was simple. Their ceremonies resemble somewhat those of the nearby Pueblos.

JIG, a machine used in ORE TREATMENT for coarsely ground material, to separate ORE from GANGUE minerals and waste rock. The material is charged into a box with a screen bottom which is then "jigged" up and down in water, or the water is pulsated to produce the same effect. Heavier ore particles settle to the bottom and lighter waste material is washed away over the top. *See also* GRAVITY CONCENTRATION.

JIGS AND FIXTURES, in machine work, a general classification of devices for holding work and guiding tools in interchangeable production. *See* PRODUCTION, INTERCHANGEABLE. Considerable confusion exists as to the correct use of the terms, many using them interchangeably. The term *jig* was probably originally used to designate devices for holding work while being drilled. A more logical distinction is to consider whether the device is really a *fixture* or not. On this basis any work-holding device which is fastened to the machine is a fixture while those which are held in the hand or located by hand on the machine table, are jigs. *See also* MACHINE TOOLS.

JIHAD, "a st iving," the Moslem "holy war." Jihad is religious warfare waged against "unbelievers" in defense of the Faith (ISLAM). If the unbelievers are "people of the book," i.e., having a scripture, they may save themselves by submission and the payment of tribute. Pure pagans must adapt Islam or perish. Jihad is enjoined in the Koran, after Mohammed had for a time counseled patience and, at most, self-defense. In general, every Moslem war is not a jihad, but only such striving as enlists the independent community as a whole. Jihad is not compulsory upon every Moslem, individually, unless it be in the sense of warfare against evils within him, but upon a sufficient number at any time to advance Islam. Some scholars have classed jihad with the five branches, or practical duties, incumbent upon all

Moslems (*see* MOHAMMEDANISM); but by common consent "holy war" is a contingent (*fard*) obligation. Political circumstance has often affected jihad as a religious dogma.

JIHLAVA (German *Iglau*), a Czechoslovak city in MORAVIA near the Bohemian frontier. The Church of St. John on the Hill was founded in 799. There are other old churches, as well as modern ones, a city hall and many beautiful parks. The chief industry is cloth and wool weaving, but there are many other varieties of commodities produced. Jihlava also is a market center for grain, lumber, flax, wool and cloth. Founded about the 12th century, the city has been repeatedly taken and retaken by warring factions. Pop. 1930, 31,031.

JIMENEZ DE QUESADA, GONZALO (c. 1500-1579), Spanish soldier and conqueror, born (probably) in Granada. He came to America in 1535 with Pedro Fernandez de Lugo, who appointed him commander of the expedition to explore the Magdalena River in Colombia. He ascended the plateau lying to the east of the river, conquered the Chibcha Indians occupying this plain and founded the city of Santa Fe de Bogata, which he successfully defended against two other explorers, Belalcazar, sent out by Francisco Pizarro, and Federman, representing the Welsers of Venezuela. His efforts to get a title from the crown to this territory, failed, and he did not return to New Granada (Colombia) until 1550, when he was made marshal of New Granada and Alderman of Bogata. From this time until 1569, when he went in search of El Dorado. his influence in the colony was very great. Unsuccessful in his quest of El Dorado, he retired to his estates and died there. With his conquests he combined both literary and intellectual pursuits.



COURTESY U.S. DEPT. OF AGRIC.

JIMSON-WEED OR THORN-APPLE

Flowering branch with leaves and funnel-form flowers; also (lower left), *spiny fruiting capsule, whence the name thorn-apple*

JIMSON-WEED (*Datura Stramonium*), a coarse, rank-smelling, highly poisonous annual herb of the night-shade family, called also stramonium and thorn-apple. It is a native of the tropics whence it has been widely introduced into temperate regions as a wayside weed. The stout green or purplish stem grows from 1 to 5 ft. high, bearing broad, thin, irregularly lobed leaves; large, trumpet-shaped, white or violet flowers, 4 in. long and 2 in. across, and very prickly fruiting capsules containing numerous seeds. The leaves and seed yield the drug STRAMONIUM, which contains daturine, a powerful narcotic alkaloid.

JINGOISM. *See* CHAUVINISM.

JIVARO or **JIVARAN**, a South American linguistic stock comprising many tribes living in eastern Ecuador and adjoining portions of northern Peru. Roughly their territory extends from the Rio Napo southwest to the Andes. The Jivaran are a virile and warlike people. The group takes its name from the Jivaro tribe who live on the upper Pastaza River in Ecuador. This tribe is famous for its *tsantsas* or shrunken human head trophies. The head is skilfully skinned and shrunk to about the size of an orange. Attendant ceremonies are elaborate and last a year or longer. The victor wears his *tsantsa* on his breast suspended by a cord around his neck, and is supposed thereby to possess certain supernatural powers.



COURTESY SMITHSONIAN INSTITUTE

JIVARO INDIAN IN FEATHER GARB

JOAB, in Biblical account, the nephew of the Hebrew king David and famous warrior and statesman in David's service. He assisted in the capture of Jerusalem as a capital for the united kingdom of Judah and Israel and wiped out the dynasty of Saul by treachery and murder. Joab was also instrumental in quelling the rebellion against David led by David's son Absalom.

JOACHIM, JOSEPH (1831-1907), Hungarian violinist, was born at Kittsee, near Pressburg, June 28, 1831. He entered the Vienna Conservatory, and made his London début at the age of 13. In 1849 he became concert-master under LISZT of the Weimar orchestra. In 1854 he was appointed concert-master and solo violinist to the King of Hanover, and in 1868 head of the Berlin Hochschule, where he remained until his death. He was among the foremost vio-

linists of the 19th century and the string quartet which he founded was recognized throughout Europe as one of the greatest ensemble organizations of all time. Joachim was also a conductor of note. His compositions include three concertos for his instrument. He died at Berlin, Aug. 15, 1907.

JOAN, the mythical heroine of a tale told by the French Dominican, Steven of Bourbon, in the 13th-century book, *Seven Gifts of the Holy Spirit.* Born of English ancestry in Mainz, she is said to have fled to Athens with her lover, a Dominican monk, and after his death, removed to Rome, where she became a cardinal and was elected to the papacy as John VIII. The author places her reign (855-858) between those of Leo IV and Benedict III, and relates that she died in childbirth during a public procession.

JOAN OF ARC, SAINT (c. 1412-31), was born between 1410 and 1412 in the little village of Domremy in the Meuse valley. Her father, Jacques d'Arc, was a well-to-do peasant, a man of prominence in his community. During the reign of Charles VI (1380-1422), the government was in the hands of rival factions, known from their respective leaders as Burgundians and Armagnacs. The latter seized the person of the Dauphin, later Charles VII. The Burgundians agreed to recognize the king of England as heir to the throne, and the allied English and Burgundian forces proceeded to the conquest of France. Domremy inclined toward the cause of the Dauphin. The tide of war flowed near enough to the village so that as a child Joan came to regard the English as enemies and the Dauphin as the hope of France. When she was about 14 she had a vision in which she believed that the archangel Michael appeared to her, and told her that the saints Catherine and Margaret would visit her, and that she should obey their voices as messengers of God. In succeeding visions, which continued for the rest of her life, these "voices" bade her help the Dauphin. Meanwhile the allies advanced, and laid siege to the city of Orleans. Now the vague commands of her "voices" became a definite order to raise the siege of Orleans and lead the Dauphin to Rheims for his coronation.

Joan made her way to Chinon, adopting male attire for better protection on her journey. The Dauphin granted her an interview. Many of the populace, and even some of the army captains came to believe her. At Poitiers a committee of ecclesiatics made a searching inquiry into her orthodoxy. The royal council then determined to send her to Orleans. With her went an army large enough to swell the Orleans garrison to equal the number of besiegers. Joan knew nothing of strategy or tactics; her one idea was to attack the enemy wherever he could be found. Spurred on by her enthusiasm and example, the French succeeded in driving off the English. On Sunday, May 8, 1429, the siege was raised and Orleans was saved. Further campaigns along the Loire opened the road to Rheims. Troyes capitulated without a struggle, and on July 16 Charles entered Rheims in triumph, escorted by Joan and the army. On the following day he was consecrated king of France.

Much remained to be done. Most of northern France was still in English hands, and the Duke of Burgundy held Paris. French councils were uncertain; a strong party desired peace with Burgundy. Charles sank once more into the apathy from which Joan had roused him. La Tremoille, his favorite, feared that further successes would jeopardize his control of the king. Joan and the army stormed Paris, but without success, and the army retreated to the Loire. Bitterly disappointed, Joan wished to attack elsewhere. Her "voices" still urged her to save France, but their directions were vague. Her prestige suffered; no longer were her efforts crowned with success. The army abandoned an effort to relieve Compiègne, besieged by the Duke of Burgundy. Saddened by the inactivity of the French, Joan with a small force of loyal troops entered Compiègne to aid as best she could. On May 23, 1430, she participated in a sally against the besiegers. Her retreat was cut off when the commander raised the drawbridge to prevent the entry of the besiegers, and she was captured by subordinates of John of Luxemburg.

From the time of her capture to the day of her death she was confined in various prisons, often subjected to rude indignities by brutal soldiers. Once she jumped from a castle tower, injuring herself. After this she was secured by chains. Charles VII, contrary to the general expectation, made no move to ransom her. Her enemies realized that if she could be proved to be a messenger of Satan rather than of God she would be forever discredited together with those who supported her. Negotiations for her purchase were entrusted by the English to Bishop Peter Cauchon, a rabid English partisan, whom the Armagnacs had driven from his see of Beauvais. She was finally sold for £10,000. Cauchon, apparently sincere in his belief that she was a witch, gained permission from the English to have her tried in his own court. The trial opened at Rouen on Jan. 9, 1431. As the trial dragged on Joan was able to disprove several of the charges, and raise doubts about the rest. Cauchon and the Burgundians redoubled their efforts, seeking to convict her by fair means or foul. Pressure was brought to bear on the doubtful members of the court, which finally, in May, declared her a heretic. To complete the case it was necessary to extort a confession from Joan. All manner of pressure, even the threat of torture, was brought to bear on the defenseless girl. Finally she was almost forced to sign a purported confession. She was then formally received back into the church and sentenced to perpetual imprisonment. She agreed to resume feminine apparel. The English were furious that she should escape alive, but Cauchon smilingly bade them wait. Rendered desperate by the indignities of her jailers and the reproach of her "voices" she resumed her male attire, which had been left convenient to her hand. Cauchon then visited her, and succeeded in getting her to admit that her "voices" still guided her. This was sufficient to prove her relapse into heresy, and she was

accordingly handed over to the secular arm and burned at the stake May 30, 1431.

For his own reputation, if for no other reason, Charles VII now became zealous in the effort for her rehabilitation. On July 7, 1456, an ecclesiastical court sitting at Rouen pronounced her condemnation null and void. She was beatified in 1909 and finally canonized by Pope Benedict XV in 1919. W. I. B.

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JOB, BOOK OF, in the Old Testament, is named after the hero of the book, a wealthy Edomite Ameer. Although "a righteous man" named Job is mentioned in EZEKIEL 14:14, it is usually thought that the subject of this book is not a historic character, a belief which is as old as the Talmud. Authorship of the work has been ascribed to many. Some scholars believe it to be the work of an Israelitish author of about 722 B.C., others claim that it was written by a Judaic author at the time of the Babylonian captivity. Still others see in it a composite work, lacking literary unity, which by editing has been gradually formed over several centuries.

The main interest of the book does not center in such questions, nor in discussions as to whether it is a drama, an epic poem or history. It is the story of "a man in the land of Uz" suddenly overtaken by dire misfortunes. In his discussions with his friends, we see the age-old problems of philosophy and theology discussed with freedom. "Canst thou by searching find out God?" "If a man die, shall he live again?" and "Is it any pleasure to the Almighty that thou art righteous?" are typical questions. The three main sections of the book, omitting the prologue and epilogue are (1) Chapters 3 to 31, containing the discussions of Job and his friends; (2) Chapters 32 to 37, containing the speeches of Elihu, and (3) Chapters 38 to 40:6, giving the speeches of God "out of the storm," and Job's brief replies. The book to-day is held in esteem, not only because it contains the story of the world's exemplar of patience, but because it is one of the greatest examples of the depth and beauty of Hebrew literature.

JOB ANALYSIS, the study of a man-job relationship. The complete job analysis, or occupational analysis, involves a study of the physical factors, such as numbers of workers in the occupation, travel distance to and from work, seasonal variations, geographical location, and so on; physiological factors, such as loads and lifts, immunity to certain diseases, age, health and sex requirements; social factors, such as the social status of workers in the occupation, existence of worker organizations, welfare and recreational activities and so on; economic factors, such as the functional or skill relations of the occupation to other occupations, insurance and old age protection, salary and other financial benefits; psychological factors, such as the requirements of the occupation in intelligence, the specific skills required, the emotional stability necessary and the interests and satisfaction offered. These factors must be considered in any complete occupational analysis.

The job analyst has developed various techniques to accomplish the job analysis, such as learning the job and studying it from the point of view of the worker; general observation of workers while at work; specialized observation by motion picture, chronocyclographic records, psychological tests and so on; experimental trials in which one task of the job is given separate study; and information gained from managers, foremen and workers.

A recent development in job analysis is from the psychological point of view in an intensive study of the man-job relations by means of mental measures. The job analysis is no longer thought of as a listing of tools and raw materials. The job analysis involves the use of tests, inventories and rating scales, by means of which average relationships are established between the tools and materials of the job and the abilities and interests of the worker. Because of the changing nature of the job, the analysis is thought of as a continuous process and the job specifications must be kept up-to-date with every new industrial development.

The job specifications, which are the product of the analysis, are of wide vocational use in improving working methods, such as regulating machine speeds, eliminating excessive and heavy handling, designing machinery; improving the health and safety conditions of work in relation to ventilation, cleanliness, instructions in the use of machinery and so on; the selection and guidance of workers by placing individuals according to measurable requirements, the forecasting of the progress of a worker in various related occupations, and promotion of workers; establishing of industrial curricula and the training of workers based upon the job specifications; and regulating of compensations based upon comparative specifications.

The purpose of job analysis from an educational point of view is to determine the qualifications and training which one should have in order to be successful in a trade or vocation, and in its most inclusive sense in the professions. After this training has been determined, the next step is to incorporate it in the educational system. D. F.

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JOB'S-TEARS (*Coix Lachryma-Jobi*), a tall, broad-leaved annual grass, closely allied botanically to the maize or Indian CORN, called also Christ's-tears. The plant is a native of eastern Asia, long and extensively cultivated in tropical countries where it often escapes and runs wild. The branching stem grows 3 to 6 ft. high, with conspicuous joints and sword-shaped leaves, and bears hard, smooth, shining tear-like or bead-like fruits. These fruits, which resemble white or bluish-gray porcelain in appearance, are widely used for beads, rosaries and various ornaments. The seed is grown as a cereal food in the Orient.

JODHPUR or **MARWAR,** a city and native state in Rajputana, India. The walled city is on the Rajputana railroad and contains the maharaja's palaces, a large fort, temples and bathing tanks The State of Jodhpur, largest in the agency, produces wheat, barley and millet. The major industrial products are silk, brassware and leather boxes. Area 34,963 sq. mi. Pop. 1921, city, 73,480; state, 1,841,462.

JOEL, BOOK OF, the second of the minor prophetical books of the Old Testament. It consists of but three chapters, and gives no indication of the place and time of the prophet's work, though the setting was probably Jerusalem. Much of his imagery appears in other books of the Old Testament, the writers of which may be indebted to him. This would tend to give the book an early date, possibly the 8th century B.C. He speaks in the name of Jehovah, prophesying judgments and giving promises to those who reform. An invasion of locusts and a drought is made the occasion for the prophecy. The Fathers interpreted this figuratively; but many modern scholars hold that it was a real calamity.

JOE-PYE WEED (*Eupatorium purpureum*), a stout, tall perennial of the composite family, called also trumpet weed or purple boneset. It is abundant in moist soils from New Brunswick to Manitoba, ranging southward to Florida and Texas. The usually smooth stem grows 3 to 10 ft. high bearing whorls of 3 to 6, large, deeply toothed leaves and dense clusters of pink or purple flower-heads. It is said to be named for Joe Pye, a New England Indian, who used concoctions of the plant in treating fevers.

JOFFRE, JOSEPH JACQUES CESAIRE (1852-1931), Marshal of France, was born at Rivesaltes, Jan. 12, 1852. He was educated at the École Polytechnique, but, before completing his course, the Franco-Prussian War broke out, and he saw active duty in command of a battery at the siege of Paris. Later he was made a captain, and fought at Timbuctoo, Madagascar, China, and in 1905 was made general of a division. In 1911, Joffre was appointed chief of staff, and on Aug. 5, 1914, two days after the breaking out of the World War, he was made commander-in-chief of the French armies. Under enormous difficulties, he held his ground in the face of the strong German offensives of Sept. 1914, and finally succeeded in checking the enemy advance at the first BATTLE OF THE MARNE. Despite these evidences of his tactical ability, the growing complexity of the war on the western front alarmed the government, and political pressure was applied, resulting in Joffre's removal from command in 1916, although retaining the title of commander-in-chief. In Dec. 1916, Joffre was created a Marshal of France. He was awarded many honors as the Grand Cross of the Legion of Honor, and was made a member of the French Academy. Joffre is the author of *My March to Timbuctoo.* He died at Paris, Jan. 2, 1931.

JOGUES, ISAAC (1607-46), Jesuit missionary to the American Indians, was born at Orleans, France, Jan. 10, 1607. After being professor of literature at Rouen university in 1636, he joined the group of missionaries under Father Jean de Brébeuf in Quebec, working among the Iroquois, the Hurons and the Mohawks. Captured by the Mohawks, he was frightfully tortured, but was finally aided in escaping by the Dutch settlers at Rensselaerwyck, N.Y. He then visited France where he was received with high honors, being called a martyr of Christ by the Pope. In 1644 he returned to his labors among the Indians, negotiating a treaty of peace between the Canadian government and the Mohawks. After a short visit to Quebec, he returned to carry on his missionary work, being the first white man to see Lake George (1646). Various calamities, including a blighted crop, having convinced the Mohawks that he was a sorcerer, he was tomahawked by one of their warriors at Ossernenon (now Auriesville), N.Y., Oct. 18, 1646. He was canonized by Pius XI, June 29, 1930.

JOHANAN BEN ZAKKAI (1st century), the most significant Tanna, or teacher of the Mishna, and Jewish scholar in the last decade before the destruction of the Second Temple in the year 70 A.D., and afterwards the founder and first president of the academy at Jabneh, near the Mediterranean Sea, between Joppa and the former Philistine city of Ashdod. He is believed to have begun his work about the year 40 A.D., and to have died about 10 years after the Second Temple was destroyed.

Johanan was the pupil of HILLEL, and was famous for his refutation of the Sadducees in questions of religious law. A member of the peace party during the wars of 66-70 A.D. against Rome, he urged the people to submit to Roman rule. When he saw that the ZEALOTS, or war party, had gained the upper hand, he had himself carried out of the city in a coffin, had an audience with the Roman general Vespasian, and obtained from him permission to establish an academy in Jabneh after the fall of Jerusalem, which was imminent. This academy soon came to take the place of the Temple; later, many other academies of the same kind were established both in Palestine and in Babylonia. He thus was instrumental in preserving the continuity of Jewish scholarship, and became the actual leader of Jewry after the destruction of Jerusalem.

JOHANNESBURG, a city of the Transvaal province, the largest city and the leading industrial center of the Union of South Africa. It is the central point of the gold fields, the richest in the world, known as the *witwatersrand,* or White Water Range. Founded in 1886, when gold was discovered nearby, the city consisted of a few shacks built on a bleak and poor upland. Today it is a modern, well-planned city, beautified by plantations of trees, especially gums planted for ornament and to supply pit props and mining timber. An excellent university is here.

Johannesburg was the center of the agitation between the British and the Boers which resulted in the Boer War. Pop. 1925, 288,131, of which 151,886 were Europeans. European pop. 1931, 203,273.

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